5-18 May 1978 First and Third Friday Volume 144 Number 3584 40p
(USA & CANADA — $1.75)

Model Engineer

MAP HOBBY MAGAZINE

Making the Jones .605

Model Engineer

Founded 1898

Incorporating Mechanics, English Mechanics, and Ships and Ship Models

Volume 144 Number 3584
5 May 1978

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Second-class postage rates paid at New York, U.S.A. Registered at the Post Office for transmission by Canadian Post. American enquiries regarding news stand sales and advertising should be sent to MODEL ENGINEER, Eastern News Distributors Inc., 111 Eighth Avenue, New York, N.Y. 10011, U.S.A.

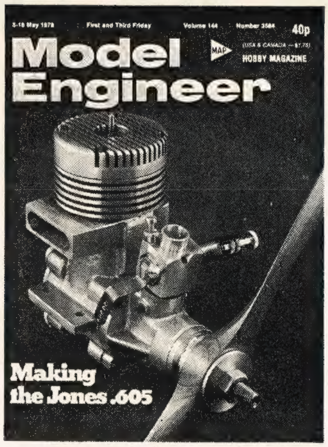
Enquiries regarding Hobby Shop Sales to Bill Dean Books Ltd., 166-41, Powell's Cove Boulevard, Whitestone, New York 11357, U.S.A. Telephone: (212) 767-6632.

Model & Allied Publications Ltd

Editorial and Advertisement Offices:

P.O. Box 35
Hemel Hempstead
Herts, HP1 1EE

Tel: Hemel Hempstead
Editorial 41224
Advertising 42501/2/3



Colin Jones's 10 cc. glow plug motor should meet many of the demands received for an internal combustion engine.

NEXT ISSUE

A pictorial assembly of Gerald Wingrove's 4½ litre Blower Bentley.

Editorial Director	R. G. MOULTON
Editor	**LES PORTER**
Technical Consultants	MARTIN EVANS
	PROFESSOR D. H. CHADDOCK C.B.E., M.Sc., C.Eng., F.I.Mech.E.
	CLAUDE B. REEVE
	GEORGE H. THOMAS
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Managing Director	GOSPATRIC HOME
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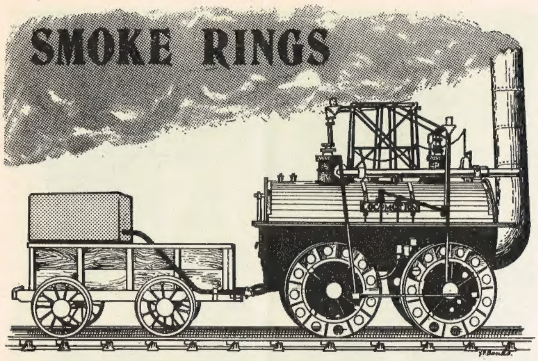
Subscription department:
Remittances to **Model & Allied Publications Ltd.**, P.O. Box 35, Hemel Hempstead, Herts. HP1 1EE (Subscription Queries Tel: 0442 51740). Subscription Rate £13.00, Overseas Sterling £13.00, U.S.A. and Canada $25.00, 1st Class Airmail $64.00. Annual Subscription includes a copy of the Model Engineer Exhibition Guide published in mid-December and the Annual Index.

ABC
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Model Engineer is printed in Great Britain by Blackfriars Press Ltd., Leicester, for the proprietors and publishers, Model & Allied Publications Ltd. (a member of the Argus Press Group), 13/35 Bridge Street, Hemel Hempstead, Herts. Trade sales by Argus Distribution Ltd., 12/18 Paul Street, London, E.C.2, to whom all trade enquiries should be addressed.

M.E. QUERY COUPON
MAY 1978



Sunny Jim off again
Whether or not you visited the R.H.&D.R. in March, you can still take advantage of a few suggestions by A. C. Fincken & Co. Ltd., printed on the backs of their packets of Force wheatflakes. There are 20 areas covered and the packet backs give details of the site attraction, times of opening etc. But to give you an idea of what to expect, there are details of the London Transport collection at Syon Park, Ironbridge Gorge Museum Trust, S.S. Great Britain, The Dart Valley Railway, and so on.

Which lathe?
Old hands who have experienced — often the hard way — all the pitfalls of choosing, buying and installing a lathe will not require the services of a booklet just published by Northfield Variform Ltd., "Choosing the right lathe for me". Priced at 50p, which is refundable if you buy your lathe from that company, the book is aimed at those model engineers either just starting to put their workshop together or those thinking of graduating from a kitchen table type to a larger machine. The book explains weights, dimensions, terminology, spindle speeds and various bits and pieces. Copies are available from the company at 11 Dales Drive, Colehill, Wimborne, Dorset.

Stuart Turner's new models
The 1978 catalogue for Stuart Turner Ltd., shows three new models in its increased size of 48 pages. These are Number 6A, the "Real", and "James Coombes". Number 6A is a revised 4 h.p. model of the old Number 6 which disappeared a long time ago. For this and the "Real" engine castings are available but no materials, for the "James Coombes" both can be supplied. Readers will also find reversing gear for the Number 10 and Double 10 engines and three kit forms of the S10 Mill engine — including a fully machined, ready to make, version. The catalogue costs 50p from Stuart Turner Ltd., Henley-on-Thames, Oxon. Please add 10p for postage.

"Clocks" ticks on
The pilot issue of *Clocks* magazine was so enthusiastically received that M.A.P. has decided to launch a regular monthly edition. The first will come out at the end of June with a July cover date and priced at 60p. The editor is Mr. Henry Massie of Tunbridge Wells who first suggested the idea of the magazine.

Welsh week-end
The Talyllyn Railway and Welshpool & Llanfair Light Railway are combining to present a joint open week-end on 13 and 14 May. If you wish to learn more, please send a stamped, addressed envelope to Mr. C. Jones, 6 Morgans Road, Eastern Green, Coventry CV5 7FQ.

Show that ingenuity
It's just about time to put aside your implements of metal torture for a while and give some thought to this year's Biro BiC Modelmaking Competition. If you haven't seen details in the company's advertisements yet, then briefly they are these: a first prize of a fortnight's holiday for two in Florida next Spring with £150 in spenders, or £1000 cash; the competitor must use BiC pens to build whatever model he/she chooses and it can be as complicated as necessary; this year BiC porous pens will also be allowed in addition to the Crystal ball pens. The closing date is 30 November so there is plenty of time to get all that writing in first (I wonder if this is the reason that my post bag always goes up at this time). Details and entry forms are available from the Great BiC Modelmaking Competition, c/o Counsellor, Red Lion House, High Wycombe, Bucks.

Where did you go over Easter?
I paid a fairly brief but extremely interesting visit to The Brighton & Hove Engineerium where in the thoroughly enjoyable company of Jonathan Minns, the Museum Director, and Bert Perryman, Chairman of Worthing & District M.E.S., I witnessed all those events described by Bert in 20 January issue, including the Shand Mason fire engine. What a beautiful bark that has got. What I did not realise is that the Engineerium offers post graduate apprenticeships in the History of Engineering — what better place for them? — lasting one year or six weeks. In that time each apprentice assists in the renovation of some machine or workshop equipment and so two functions are fulfilled at the same time. Weatherwise the day was disappointing and we were unable to operate the portable track which the Worthing club had arranged nor visit the Brighton and Hove club's track next door. But perhaps next time it will be better and this is one of those places where you just have to go again.

MODEL ENGINEER EXHIBITION

THE HOT AIR ENGINE COMPETITION

by Prof. D. H. Chaddock

THE ENTRIES FOR THE competition this year were disappointingly few, only three, one of which did not turn up. But the models which did arrive were old friends, engines which had been in the competition last year but had been modified and developed in the meantime.

Mr. F. R. Wilkinson, who last year received one of the special prizes for originality of design of his double acting, twin displacer engine, had made some very significant alterations which were to prove sufficient to make him the outright winner this year. A photograph of the engine in its present form (Fig. 2) shows that, compared with last year, the position of the displacer cylinders has been inverted, that is to say they are now above instead of below the double acting power cylinder. In this position, fired by dual ring burners of the "Andy Ross" type and enclosed in short chimneys to comply with the "no external flame to be visible" rule, heating was certainly very effective and, perhaps even more important, waste heat escaped up the chimneys instead of being added to the load carried by the cooling water. The linkage driving the displacer was of course now placed below the power piston and its connecting rod instead of being above it.

Most important however was the provision that Mr. Wilkinson had made for the engine to be pressurised up to the maximum permitted pressure of 100 p.s.i.g. Since the power piston rod and both of the displacer piston rods passed through glands anyway it was only necessary, after ensuring that they really were airtight, to add a charging point with a non-return valve and, to comply with the rules, a pressure gauge and safety valve. This of course had to be in duplicate because each side of the engine, being entirely separate, had to be charged independently. In sealing his engine so that it complied with the "one hour" rule, Mr. Wilkinson was brilliantly successful — in fact pumped up by a hand pump on Friday for its official test it still had 60 p.s.i. on the gauges the following Monday!

From his rhombic drive, external piston engine entered last year without pressurisation, Mr. F. B. Thomas of Hereford adopted a different strategy. Realising that the tail of the displacer rod would provide an ideal drive for it, he added an air pump to the bottom of the crankcase opposite to and driven by the displacer crosshead. This made the engine self-pumping, that is to say that starting with only atmospheric pressure inside the engine, as it ran the pressure was built up automatically. The design and manufacture of such a tiny air pump, only 0.125 in. bore by 0.522 in. stroke, was no mean achievement in itself and although at the present stage of its development it was not able to raise the engine pressure to more than 40 p.s.i.g., this gave a substantial increase in the power of the engine compared with its unpressurised perform-

ance. Other modifications to the engine, shown in Fig. 3, include the regulation flame guard and most amusingly a second hot air engine to drive the circulating water pump. This is in fact a replica of the miniature fan engines described by Dr. J. Senft and which, deprived of its fan and placed on its side, is driven entirely by the waste heat of the main burner. It certainly did an excellent job of work and kept the water circulating between the finned radiator vessel, the engine cooling jacket and the storage tank.

Because of the limitation in the internal pressure which its inbuilt air pump could produce, and the engine not being sufficiently well sealed to comply with external pumping and the "one hour" rule, only a modest increase in power was recorded over its performance last year, namely 3.71 watts at 1670 r.p.m. compared with 2.59 watts at 2000 r.p.m. It is still thus below the performance of Dr. Senft's very similar engine which last year recorded 4.69 watts at 1200 r.p.m. and an internal pressure of 30 p.s.i.g. It is possible that the power taken to drive the air pump is detracting appreciably from the extra power gained by pressurisation.

In contrast Mr. Wilkinson's engine, which was so well sealed that it required no pumping to maintain even a pressure of 100 p.s.i.g., had no extra load to contend with and on its official run turned in 7.10 watts at 1067 r.p.m. and was thus a clear winner.

So interesting was this result that Mr. Wilkinson very kindly allowed me, after the official run was over and during the rest of the Exhibition, to run a complete series of power curves at pressures of 40, 60, 80 and 100 p.s.i.g. The results are plotted in Fig. 1, to which has been added the results obtained in the 1977 competition when the engine was unpressurised. The increase, sevenfold, is truly remarkable and shows the very great advantage to be obtained from pressurisation. The pressurised curves, however, show the peculiar characteristic upon which I commented last year, namely that whereas the curves for the lower pressures show a typical hump-backed form at the higher pressures the maximum power and torque are developed at the lowest speed at which the engine would run and are in a sense incomplete. All the curves show a more or less rapid fall off in power as speed increases and tend to reach a common level at around 1700 r.p.m. This result is, I think, due to the inability of the engine to transmit more than a certain amount of heat to the air inside it with the result that, regardless of the speed or

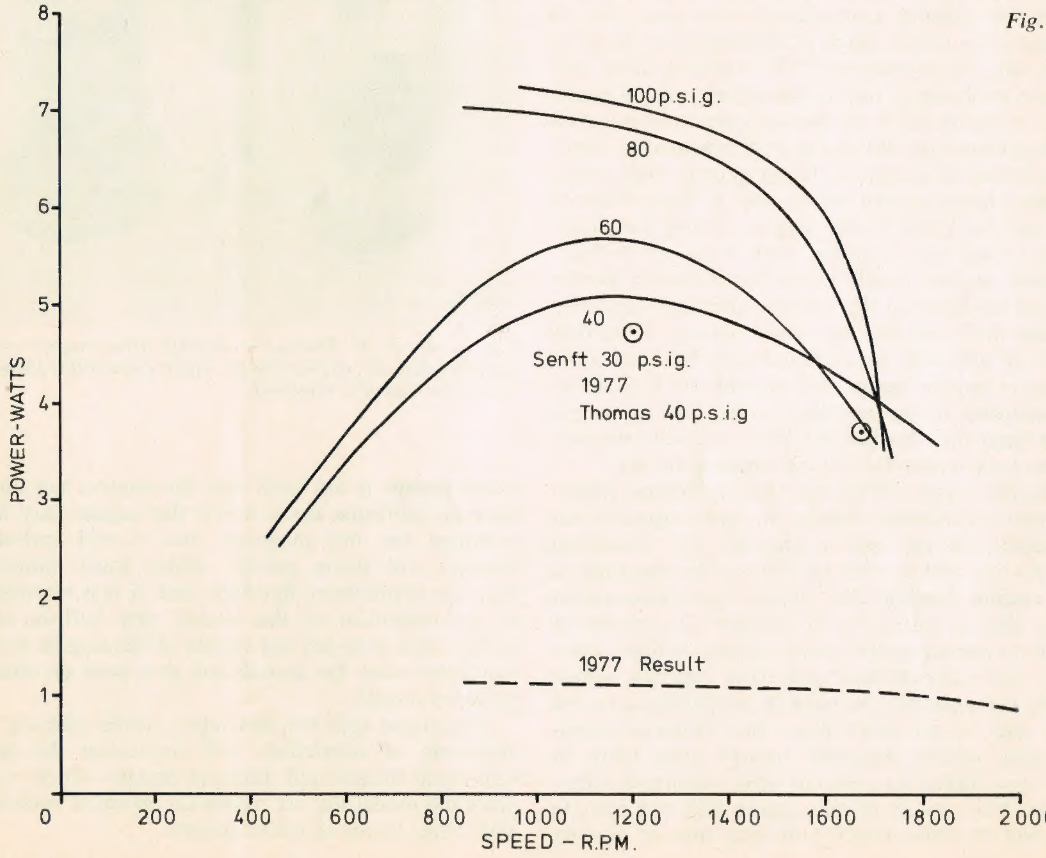


Fig. 1

pressure, it runs out of "puff" and this despite certain alterations Mr. Wilkinson has made to increase the internal heating surface.

On the same graph I have added the results for Dr. Senft's engine last year and Mr. Thomas's engine this year. Bearing in mind the lower pressure at which it was running, the former comes very close indeed to the more recent results both in regard to the maximum power and the speed at which it was developed. Mr. Thomas's engine on the other hand comes very close to the "heat limit" point and it would seem that if it could have been run more slowly it would have developed more power. This however was not possible because the engine needed to be run at a good speed, at least 1600 r.p.m., for the air pump to build up its maximum pressure. This engine is not particularly airtight, it rapidly loses its pressure after running, and it may be that if the sealing were improved not only would the air pump have less to do but it might build up an even higher pressure and hold it at the lower speed at which the engine, according to all available evidence, should develop more power.

Finally, in thanking Mr. Clark for his generous donation of the prizes and the competitors for their efforts, I am happy to say that there will definitely be another competition next year but to encourage a wider range of development an extra class will be introduced. The existing class will remain unchanged, that is for engines with a maximum capacity of 5 cc. per cylinder and a maximum pressure of 100 p.s.i.g. with reasonable safety precautions in regard to flame guards, fuel tanks, pressure hoses, safety valves, etc. A First Prize of £50 will be given to the engine giving the maximum power per cylinder, that is to say a four-cylinder engine would have its recorded power divided by four, so that single- and multi-cylinder engines will compete on equal terms. A Second Prize of £20 will be awarded for the next most powerful engine except that should the First Prize be awarded to an engine running on some gas other than air, the Second Prize will be awarded to the most powerful engine running on air.

The new class will be open to *any* engine, single- or multi-cylindered, having a total capacity not exceeding 50 cc. and a pressure not exceeding 100 p.s.i.g., and a prize of £50 will be awarded to the engine having the highest power-to-weight ratio, that is watts per lb. weight. The object of this is to encourage the development of light, compact, but nevertheless powerful engines which could, for example, be used in propelling a model boat and to get away from the Victorian monstrosities which, excellent though they were in their way, failed to compete with modern developments. The weight of the engine will not include any fuel or water tanks, radiators, fans or cooling water pumps if not built into the engine, nor any base or subframe upon which the engine may be mounted for test purposes, but it will include burners and flame guards, which must comply with the regulations, flywheel, and, if it is essential to the operation of the engine, any built-in air pump—that is to say the weight of the engine as it would be ready for installation in a boat or other powered model.

It is hoped that this new class, while offering a minimum of restriction, will encourage the development of new and practical designs which will place the model hot air engine on an equal footing with other forms of prime mover.

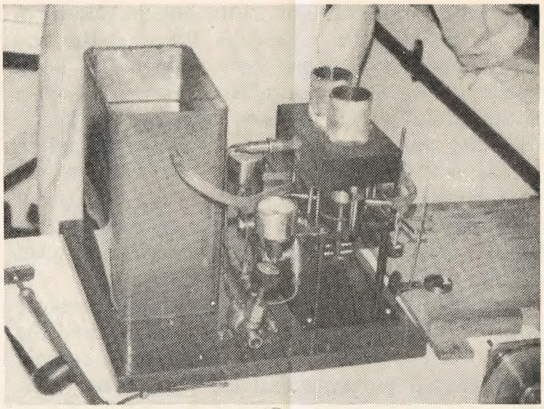


Fig. 2: First place went to Mr. F. R. Wilkinson's double acting dual displacer engine.

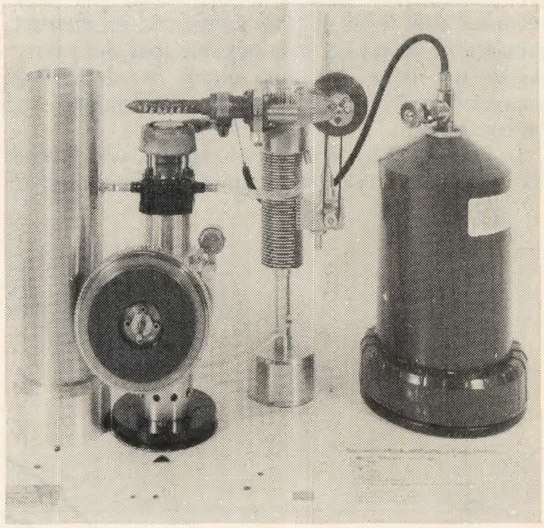


Fig. 3: Mr. F. B. Thomas's rhombic drive engine with auxiliary hot air engine-driven water circulating pump. The flame guard is removed.

MODEL ENGINEER HOT AIR ENGINE COMPETITION

To be held at the 1979 Model Engineer Exhibition

A THIRD COMPETITION to encourage the design and building of model hot air engines will be held at the 1979 Model Engineer Exhibition. Prizes have again been generously donated by Mr. A. N. Clark of Ryde and Professor D. H. Chaddock, C.B.E., will again conduct the Trials and act as Judge. In order to encourage a wider range of development the competition will be open to two Classes of entry, the rules of which will be as follows:

1. 5 cc. Class 'A'. The swept volume of a single working cylinder shall not exceed 5 cc. Multi-cylinder engines, i.e. engines having more than one complete and separate working space, shall not exceed 5 cc. per cylinder and the total recorded power shall be divided by the number of cylinders in assessing the results. Double acting cylinders shall be treated as multi-cylinders provided that the working spaces are entirely separate.

2. 50 cc. Class 'B'. Any engine, single or multi-cylinder, having a total capacity not exceeding 50 cc. The Prize will be awarded to the engine having the highest power to weight ratio, that is to say power divided by weight. The weight of the engine will not include any fuel or water tanks, radiators, fans or circulating water pumps if not built into the engine, nor any base or sub-frame upon which the engine may be mounted for test purposes. It will, however, include burners and flame guards which must comply with the regulations, flywheel and, if it is essential to the operation of the engine, any built-in air pump.

General regulations applicable to both Classes

3. The engine entered must be the unaided work of the competitor.

4. No entry will be accepted from a professional model maker.

5. The decision of the Judge/s will be final.

6. Engines may operate on an open or closed cycle. The working fluid may be other than air and may be pressurised to a static pressure not exceeding 100 p.s.i.g. Engines may be pressurised either by:

(a) An air pump continuously driven by the engine, but no allowance will be made for the power absorbed in so doing.

(b) From an external source, foot or hand pump, at least one hour before the start of the trial, after which they will be disconnected and no further topping-up or re-pressurisation allowed.

(c) Externally driven pumps and/or the permanent connection of the engine to a reservoir or container other than that of the engine itself will not be allowed.

(d) All engines intended for pressurisation shall be equipped with accurate pressure gauges and safety valves or blow-out discs set to act at not more than 10 per cent above the maximum cyclic pressure.

(e) Before running, all engines intended for pressurisation shall be subject to a cold static pressure test to twice the maximum cyclic pressure or a certificate to the effect that such a test has been carried out shall be submitted.

7. Internal combustion and liquid/vapour cycle engines will not be accepted.

8. In engines having two or more pistons connected to the same working space the swept volume shall be the difference between the maximum and minium volumes of the working space.

9. Working fluids other than air may be used but inflammable and explosive gases such as hydrogen will not be permitted. In engines pressurised with air, or other gas containing oxygen, hydro-carbon lubricants which might evolve explosive vapours when heated shall be excluded from the working space.

10. The fuel tanks of engines fired by liquid fuels, methylated spirit, paraffin, petrol etc. shall not contain more than 100 cc. (3½ fluid oz. approx.). The tanks must be made of brass or copper with all joints silver soldered or brazed. Tinplate tanks with soft soldered joints will not be permitted. All tanks must be readily removable from the engine and fitted with screwed stoppers so they may be filled and closed outside the exhibition area.

11. Engines fired by butane, propane, Calor gas, Camping gas etc. shall be connected to the supply cylinders by copper pipes and screwed unions or by commercially available and approved flexible pipes with screwed unions. Push-on plastic or rubber tubes will not be permitted. Preferably standard commercially available Camping Gaz containers and fittings shall be used but other commercially available fittings and containers may be used. Modifications to manufacturers' equipment will not be permitted.

12. For engines not equipped with their own gas supply the connection to the burners shall terminate in a male union with a ¼ in. x 40 t.p.i. thread

and an internal conical seating of 60° included angle for connection to gas supplies which will be provided by the organisers.

13. All engines shall be equipped with furnaces or flame guards so that no external flame is visible when the engine is running. Stop cocks, dampers or the like shall be provided so that the flame may be rapidly extinguished in emergency.

14. The power output of the engine will be measured by a friction brake with a lever arm and weights.

15. Speed measurement will be by revolution counter and stop-watch.

16. All engines must have a standard output shaft 5/32 in. dia. and approximately ¾ in. long.

17. All engines will be scrutinised by the Judge/s before being allowed to take part in the competition and may be refused permission to run if in their opinion the design, workmanship or construction might constitute a hazard to safety. The Judge/s may also order a trial to be terminated if in their opinion a hazard to safety has or might develop.

18. Competitors have the option to run their own engines themselves under the scrutiny of the Judge/s.

19. Competitors not intending to run their own engines should submit with their entry notes for the Judge/s regarding lubrication, firing, warming up procedure, maximum and minimum speed at which the engine should be run, etc.

20. The duration of each run shall be left to the discretion of the Judge/s.

21. Winners will be required to submit details, photographs and drawings of their engine to the Editor for publication in *Model Engineer*.

22. Although every care will be taken the Organisers will not be held responsible for any damage to the engines during the trials.

23. Details of entries must be sent to the Exhibition Manager, M.A.P. Ltd., not later than 1 December 1978.

Prizes

1. A first prize of £50 for the engine developing the highest horsepower per cylinder in Class 'A'.

2. A first prize of £50 for the engine developing the highest horsepower per pound weight in Class 'B'.

3. In the event that either or both of these classes are won by engines not operating on air a second prize of £25 in each class for the best engine using air as its working fluid will be awarded.

MODEL ENGINEER EXHIBITION

THE LOCOMOTIVES

by Peter Dupen

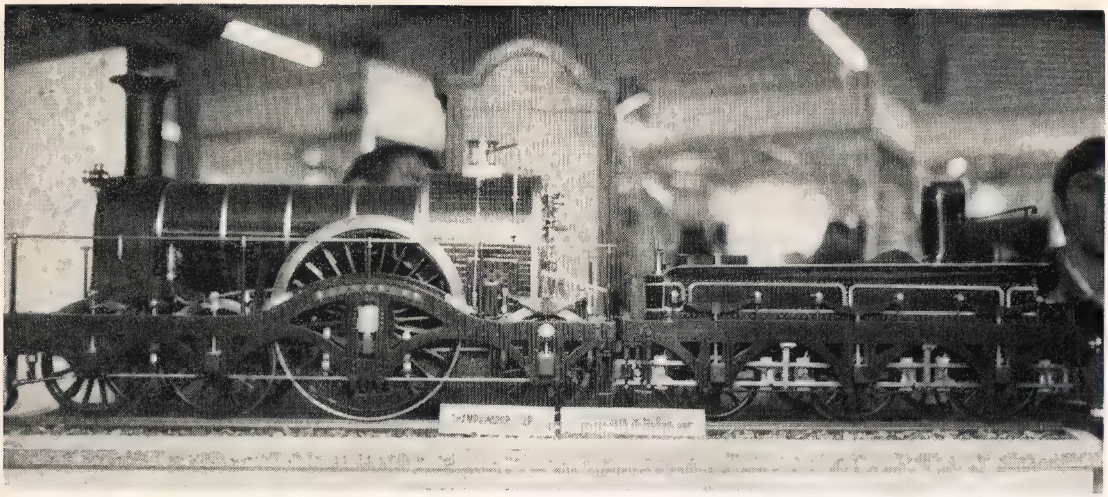
THE NUMBER OF LOCOMOTIVES entered for this year's competition was an improvement on last year, a total of 14 against 12 for 1977, and included a variety of interesting and well-made models.

The outstanding model was undoubtedly the 7¼ in. gauge G.W.R. broad gauge 8 ft. single "Lightning", by Mr. R. M. Ordish of Blandford. As the prototype ran on 7 ft. gauge the scale of the model was approximately 1 1/32 in. to 1 ft. and so the model was comparatively small by 7¼ in. gauge standards, food for thought for anybody contemplating modelling in this gauge but is limited by machine or handling equipment and unable to tackle the more modern standard gauge prototypes. There is no reason why a model of this type should not have a good track performance and would certainly attract a great deal of interest.

The prototype for the model was the celebrated "Iron Duke" class built at Swindon in 1847 by Daniel Gooch, a very advanced design for the period, built with sandwich-type frames and also a centre frame giving an additional bearing for the crankshaft. Gooch's stationary link motion was of course fitted to these locos.

All these items were faithfully included on the model, as were the boiler feed hand pump, which must have taxed the fireman's strength, and the elaborate one-sided tender hand-brake operated by rack and pinion. The general workmanship on the model was extremely good, the inside motion and wealth of fine detail work providing hours of study for loco enthusiasts. Mr. Ordish is to be congratulated on building such a fine model and well deserved the Championship Cup and Crebbin Memorial Cup he was awarded. There is no doubt he must have spent some considerable time on research for authentic details, and the model looked even better for standing on a length of G.W.R. longitudinal sleeper track. Could the model be improved? The paintwork and lining were not quite as good as the engineering, and pipe flanges were used in place of union nuts on clacks and pump. A running loco? Yes, for concealed under the buffer beam was a conventional model cylinder lubricator.

A Silver Medal and the J. N. Maskelyne Memorial Trophy was awarded to Mr. I. E. Lewis of Solihull, for a model in 3½ in. gauge of the L.M.S. Stanier Class 5 4-6-0 type locomotive No. 44943 in B.R. livery, a real maid-of-all-work loco



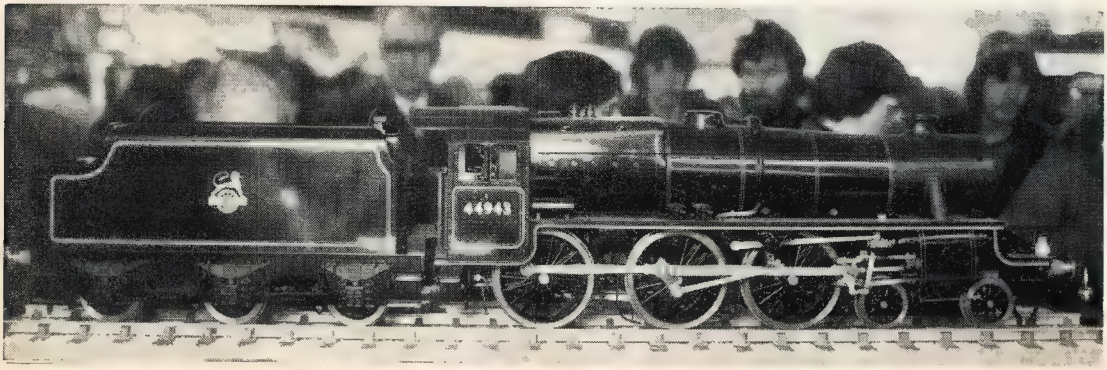
Winning model of G.W.R. broad gauge 8 ft. single by Mr. R. M. Ordish

introduced in 1934, but the model was of a later type with domed boiler. The motion work and details were very good including correct studded glands on piston rods, one of the few models to include this feature, but why taper pins in the crossheads and not cotters, also the slotted head screws retaining the leading coupling rods? A small detail, yes, but a small amount of extra work would have eliminated these faults.

The paintwork and lining in the simple B.R. style was very good, and so was the platework and riveting it covered. The cab and boiler fittings for a working 3½ in. gauge loco generally have to be oversize but they can be made to look a little more like the prototype, and the extra effort is well worthwhile.

Another L.M.S. locomotive, this time a M.R. 4-4-0 Compound No. 934 in 3½ in. gauge, was entered by Mr. V. C. Cotrel, also of Solihull. The prototype was one of the most successful compound locomotives built in this country, the model being one of the later type built by the Vulcan Foundry in 1927 for the L.M.S. and with left-hand drive. The model, like the prototype, had an inside H.P. cylinder with piston valve and two outside L.P. cylinders with slide valves, a Deeley regulator in the dome to provide for both simple and compound running. As with many outside cylinder 4-4-0 locomotives the coupling rods were placed outside the connecting rods to reduce the bending moment on the pins; Mr. Cotrel has reversed this arrangement on his model in order to gain extra clearance for the cylinders. A very well-made model with a considerable amount of detail work, but the fluting on the rods was not quite up to the general standard of other mechanical work, nor were the screwed glands on the piston rods and the taper pins in the crossheads. The platework cab layout and boiler fittings were excellent and shows it can be accomplished in 3½ in. gauge, painting, lettering and lining were very good, but the white lining should have been yellow for an L.M.S. locomotive. An excellent model which well deserved the Silver Medal awarded, it should be a most interesting model to drive, a future I.M.L.E.C. winner? But I doubt whether com-

Mr. I. E. Lewis's 3½ in. gauge L.M.S. Stanier Class 5 4-6-0 locomotive.

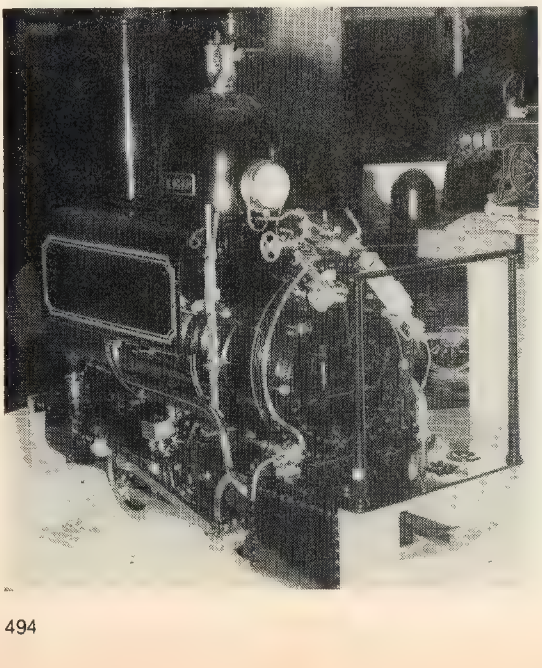


pounding would show any advantage in a model of this size.

An unusual model was a 5 in. gauge 0-4-0 saddle tank L. & Y.R. works shunter "Wren". These 18 in. gauge locomotives built by Beyer Peacock in 1887 were used as internal transport at the Horwich Works, there being several miles of 18 in. gauge track. This is always a prominent feature in photographs of the works. A 5 in. gauge model is a scale of 3.33 in. to 1 ft.; using a scale such as this is no problem with modern calculators. Mr. G. J. Kimber of Ditton, builder of the locomotive, was able to make full use of the large scale and the model was no doubt the most authentic in the loco section, no design concessions need be made, every item can be made to scale with the knowledge that it will work, and work well. The only problem likely to be encountered is the circular firebox, which, as on the prototype, means a shallow fire and restricted ash capacity; a deep fire on a model gives boiler stability, a good feature, but not a necessity. I hope Mr. Kimber will let us know the problems he encounters on steam trials, which I understand will take place later this year. The workmanship in the model was excellent, the Allen straight link motion could just be seen between the frames and was very good, the boiler fittings would bear close inspection and could not be faulted, but of course they were rather large compared with most model fittings. Platework and riveting were also very good, painting and lining were not up to the otherwise excellent standard. A very attractive and unusual model and well deserved the Silver Medal awarded.

A Bronze Medal was awarded to Mr. A. C. Hall

Mr. G. J. Kimber's L.&Y.R. "Wren" in 5 in. gauge.



of Feltham for a 5 in. gauge model of L.N.E.R. 4-6-0 "Gemsbok" based on Martin Evans' "Springbok", a very nice model well made and finished but lacking in the finer detail work. It no doubt has a fine performance on the track. The paintwork and lining were very good but the green colour was far too light for L.N.E.R. green and brass handrails and knobs rather spoilt the overall appearance.

Another Bronze Medal went to Mr. B. Gavins of West Yorks. for a very nice model in 5 in. gauge of a G.W.R. 0-6-0 Dean Goods tender engine. This model had obviously done a considerable amount of running and no doubt runs very well, but it lacked the detail finish, no flap between engine and tender, safety valve casing out of solid and not sheet brass as the prototype; the motion work was very good but with an open cab, boiler fittings must be more to scale to give the correct appearance.

An LBSC "Pansy" or a 5 in. gauge G.W.R. 57XX by Mr. D. J. Roberts of Horley was awarded a V.H.C. and also the New Zealand Cup, a nice clean well-finished model of this popular locomotive. Mr. T. H. Withnel of Preston entered another LBSC design, this time "Doris", a 3½ in. gauge L.M.S. Class 5, and was awarded a H.C.

Two "Rob Roys" in 3½ in. gauge were attractive locos, one being by Mr. B. Goldsmith of Luton who was awarded a H.C., and the other by Mr. C. B. Chandler of Beaconsfield, awarded a Commended. Both were very neat models, but Mr. Chandler's was spoilt by the poor buffer heads and white painted backhead. A M.R. 4-2-2 "Princess of Wales" in 5 in. gauge was the work of Mr. E. Fox of Worksop. It was a beautiful prototype but the workmanship of the model did not do this justice, and there was far too much polished brass-work which only emphasised the fact that incorrect materials had been used. Yet another LBSC design, and still as popular as ever, was an Invicta "Canterbury Lamb" by Mr. A. P. Foster of Cardiff. These are always pleasant to look at but it needed a better finish.

No Exhibition would be complete without a "Tich" and this year it was Mr. L. C. Brunger of Weymouth who provided the example neatly finished in G.W.R. livery. Last but not least is a very original design in 3½ in. gauge by Mr. J. W. Creasey of Slough. A 4-6-0, with double-acting oscillating outside cylinders, which, given good design and workmanship, should be just as efficient as the most sophisticated valve gear in a model of this size, but the workmanship on this example could have been improved.

In conclusion, a very good Exhibition but not a locomotive vintage year. Let us look forward to 1979.

A Light Compound Steam Tractor

at 2 in. Scale

Part XI **by John Haining** *From page 391*

IN THE LAST ARTICLE I inadvertently referred to the bore of the boiler feed pump as being ⅜ in. — this should have been quoted as 5/16 in., slightly larger than the bore of the Aveling 2 in. scale roller feed pump, which could well benefit from that extra 1/16 in. in bore size over its present ¼ inch. Also, I am using *cast iron* gears for both the pump drive wheels, securing the crankshaft gear by grub screw and not key as mentioned.

Regarding fitting the pump to the nearside hornplate; as the plates are attached to the firebox outer wrapper by means of setscrews screwing into four hollow stays each side, I decided to utilise one of these No. 2 BA setscrews to attach the pump body to the hornplate, taking all the thrust by two steel dowels set in the plate and pump body.

Before drilling the 3/16 in. dia. hole through the pump body for the securing setscrew, set the pump eccentric at the bottom of its stroke, with the pump plunger at its lowest extended position to make sure that the plunger does not "bottom" on the end of the bore before the eccentric has completed its travel.

This is really more important than correcting any slight angular misalignment between the pump centreline and centreline of the driven pump gear or stubshaft, which unless it is really excessive is hardly likely to detract from the performance of the pump.

Clamp the pump to the hornplate while the position is being determined by trial and error and when it is correctly in position, mark around its outline before unclamping. Make a stiff paper template of the exact body outline, cut out and place over the marked outline on the hornplate, marking off the hollow stay hole position onto the template for transfer back onto the pump body. Inside the pump I have retained the delivery ball in its lift by the turned down setscrew and the suction ball by a 1/16 in. dia. pin sweated in place. The screwed union in the suction line acts as the ball seat.

The ashpan, on the full size engine is held up in position by three hanger brackets attached by set screws at the top end to the firebox sides and at the bottom riveted to the ashpan sides, plus one ½ in. stud 6¼ in. long with clip riveted to the bottom of the pan at the tender end on the flywheel side. Mr. Limb tells me that due to the difficulty of access to this stud and clip it is usually left off, the three hanger brackets being quite adequate to support the weight of the ⅛ in. plate ashpan.

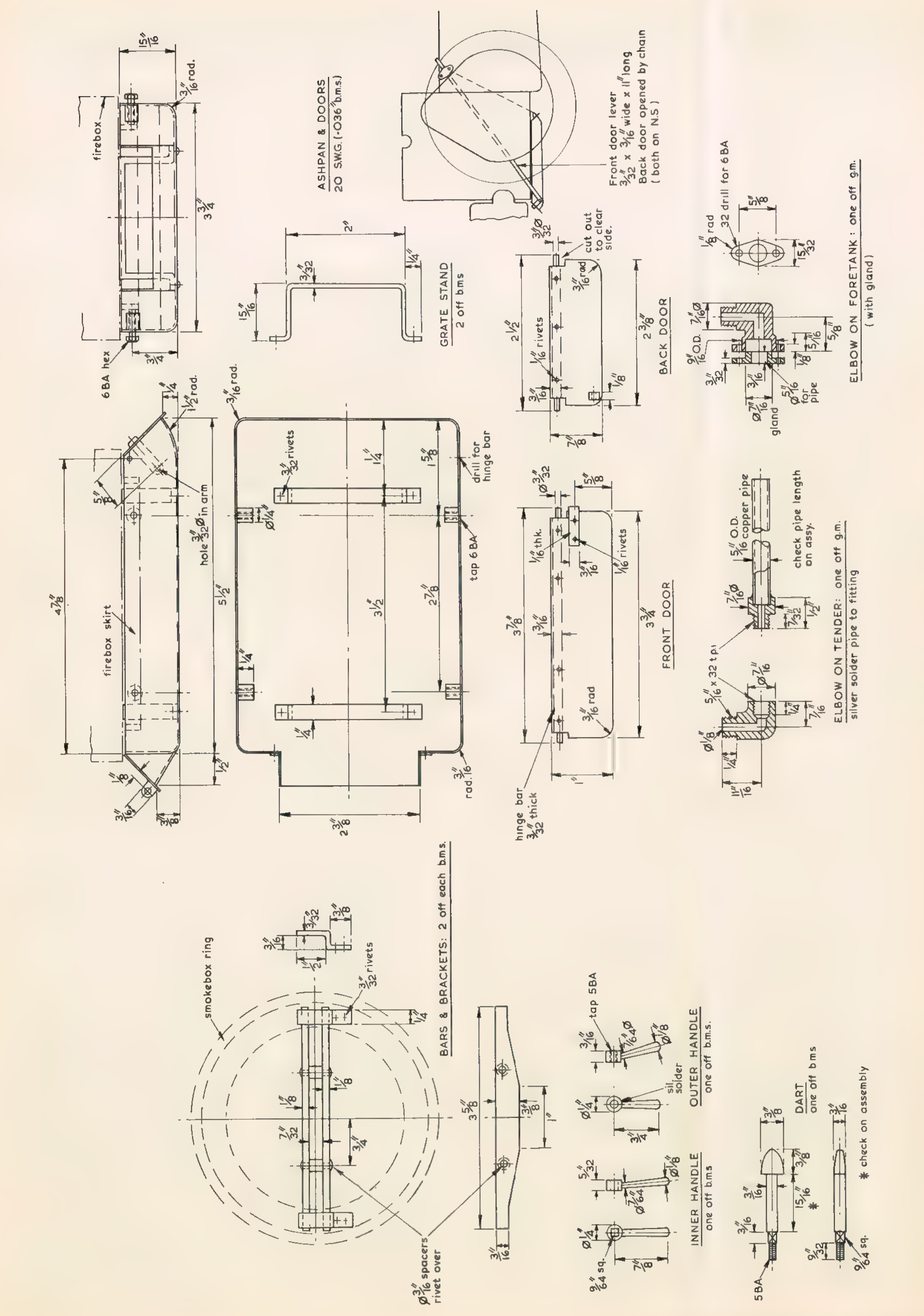
On the two inch scale version of the ashpan I have not followed this method of attaching the pan as it would involve drilling and tapping the firebox sides and is rather "fiddly" to get at, particularly when hot. Instead the ashpan has four bosses attached to the inside, two at each side drilled and tapped No. 6 BA for hex. head setscrews which engage with deep dimples or holes 32 drill dia. in the lower skirt of the inner firebox where it projects 5/16 in. below the foundation ring — this is what this extension is for, making it unnecessary to add any further holes to the boiler itself for brackets or studs, and in my opinion fully justifying the little bit of extra copper sheet involved.

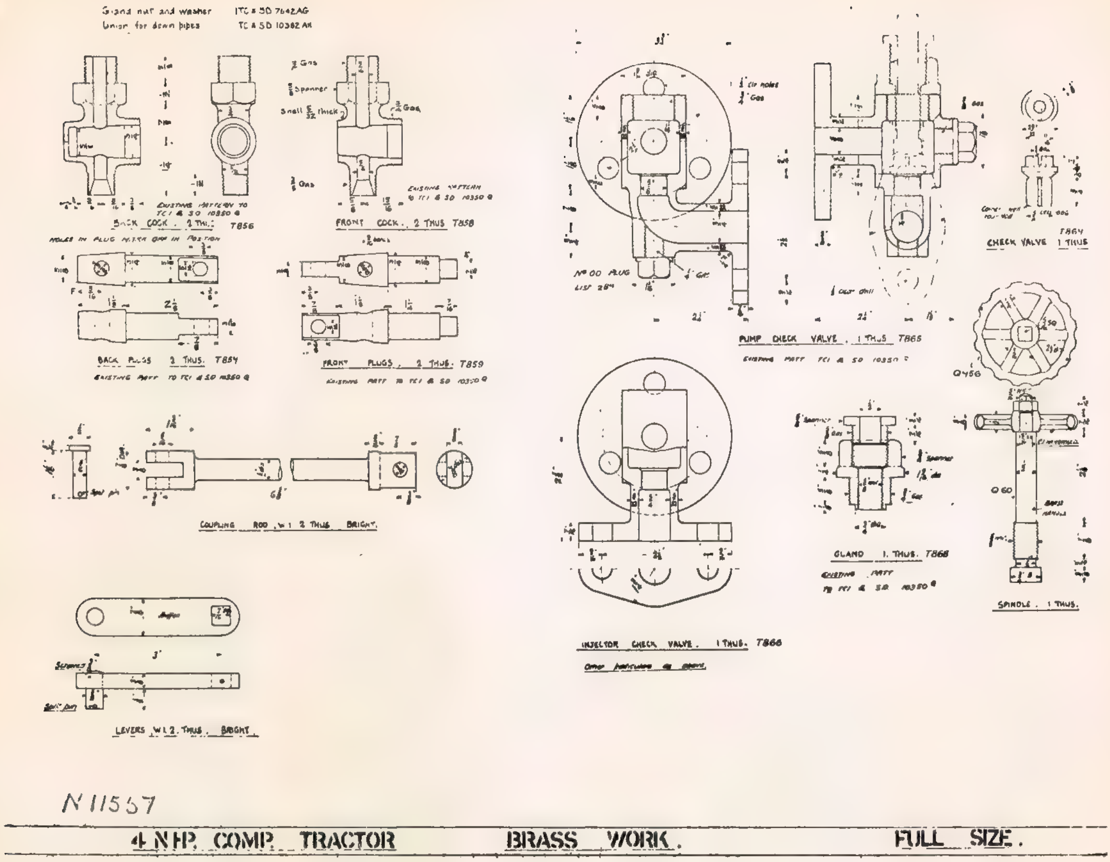
The firebars are held up in position by the two ¼ in. x 3/32 in. thick rests riveted to the ashpan bottom and the whole assembly, pan plus firebars can be quickly dropped by slacking off the four hexagon 6 BA setscrews on the outside. The same result could be arrived at by supporting the ashpan by means of two ⅛ in. b.m.s. bars running through holes in the lower skirt from side to side, with the firebars resting on top of them, but these are liable to distortion by heat with consequent difficulty in dropping grate and pan.

The ashpan, in plan view, has a flap door at the front end, running the full width of the pan, with a narrower door at the back or tender end, closing over the extended rear section of the pan.

The front door is opened and closed by a long lever running from the top of the tender side just behind the hornplates on the nearside; the back door is shown on the original Ransomes drawing as being controlled by a similar lever, but on the later ashpan detail drawing this rather clumsy arrangement is modified by substituting a chain for the lever on the back door, retaining the long lever on the front door only. At the top this is shown passing through a small plate bracket or guide with a setscrew each side of the lever securing it to the top edge of the tender side.

Although not shown, the lever lower face will have to be serrated in order to retain the door in its open positions — a series of rounded notches cut with a small Abrafile will enable the lever to drop


ASHPAN & DOORS
20 S.W.G. (·036" b.m.s.)
GRATE STAND
2 off b.ms
BACK DOOR
FRONT DOOR
ELBOW ON FORETANK: one off g.m.
(with gland)
ELBOW ON TENDER: one off g.m.
silver solder pipe to fitting
BARS & BRACKETS: 2 off each b.ms.
INNER HANDLE
one off b.ms
OUTER HANDLE
one off b.m.s.
DART
one off b.ms
* check on assembly



Some of the Orwell Works brass fittings used on the 4 N.H.P. Steam Tractor.

over the lower setscrew in the required positions. Both setscrews will require backing pieces just over the thickness of the lever to enable the lever to move up and down through the guide.

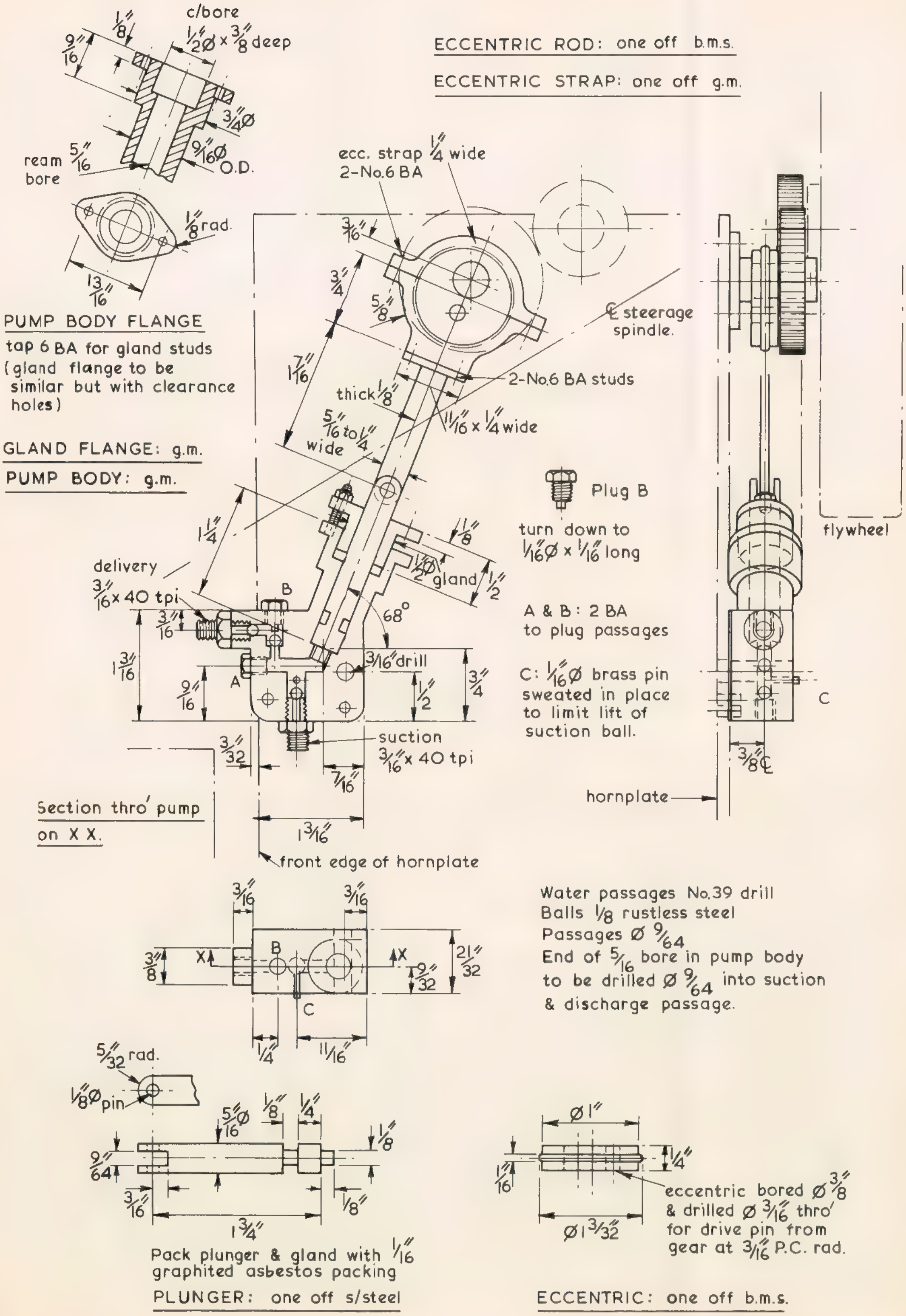
I am including a series of 1/16 in. dia. holes near the end of the lever to hitch the chain onto when opening the back door flap.

The Ransomes drawing shows a sliding door in the side of the ashpan, but I have not included this on the two inch scale engine; if extra air is needed over that provided by both open doors I shall include several ⅜ in. dia. drilled holes in the flat bottom of the ashpan. The pan sides will have to be drilled on assembly to take the round hinge bar extensions, and as the bars are wider than the actual ashpan — as on the full size engine drawings — the hinge bars will have to be sprung into position during construction of the pan itself, and the doors riveted to the bars after they are inserted in position. This does not appear to be a very easy way of doing the job, so I would recommend that the hinge bars be cut in half and then inserted into their respective holes, riveting to the doors afterwards.

Nobody is going to detect this departure from full size practice as the bars are on the inside of the door flaps anyway.

The ashpan is an awkward shape to manufacture, as it is fully radiused at all corners both in plan and elevation. I have not yet started on my own but intend to build up in separate curved and straight sections, using 20 s.w.g. (.036 in.) thick bright m.s. sheet and silver soldering all joints where necessary incorporating butt straps of the same material inside.

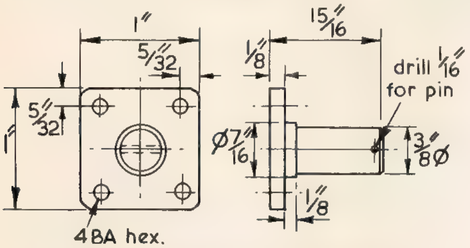
The balancer pipe between foretank and tender is included on the same drawing sheet as the ashpan, which it runs alongside on the offside of the firebox. In full size the pipe screws into the rear elbow, on the tender, while sliding into the gland of the front elbow, below the foretank on the offside. For obvious reasons this is not possible on the 2 in. scale engine, so I have adopted the method shown on my drawing for attaching the pipe to the back elbow while retaining the correct glanded elbow under the foretank. The bushes, tapped 5/16 in. x 32 t.p.i. in both tender and tank are slightly larger than necessary in order to simulate the appearance of the


c/bore
1/2"Ø x 3/8" deep
ream 5/16" bore
3/4"Ø
9/16"Ø O.D.
1/8" rad.
13/16"
PUMP BODY FLANGE
tap 6 BA for gland studs
(gland flange to be
similar but with clearance
holes)
GLAND FLANGE: g.m.
PUMP BODY: g.m.
ECCENTRIC ROD: one off b.m.s.
ECCENTRIC STRAP: one off g.m.
ecc. strap 1/4" wide
2-No.6 BA
℄ steerage
spindle.
2-No.6 BA studs
thick 1/8"
11/16" x 1/4" wide
5/16" to 1/4" wide
Plug B
turn down to
1/16"Ø x 1/16" long
flywheel
delivery
3/16" x 40 tpi
B
1/2" gland
68°
A & B: 2 BA
to plug passages
3/16" drill
A
C: 1/16"Ø brass pin
sweated in place
to limit lift of
suction ball.
C
suction
3/16" x 40 tpi
3/8" ℄
hornplate
Section thro' pump
on X X.
front edge of hornplate
Water passages No.39 drill
Balls 1/8 rustless steel
Passages Ø 9/64
End of 5/16 bore in pump body
to be drilled Ø 9/64 into suction
& discharge passage.
X
B
X
C
5/32" rad.
1/8"Ø pin
Pack plunger & gland with 1/16"
graphited asbestos packing
PLUNGER: one off s/steel
Ø1"
Ø1 3/32"
eccentric bored Ø 3/8"
& drilled Ø 3/16" thro'
for drive pin from
gear at 3/16" P.C. rad.
ECCENTRIC: one off b.m.s.

flanged joints on the big engine. The copper tube is standard ¼ in. I.D. x 5/16 in. O.D. as used with ¼ BSP air fittings etc., the two elbow bodies formed from two gunmetal blocks.

The firms building traction engines and steam tractors, steam wagons, rollers and ploughing engines, often bought out such fittings as cylinder drain cocks, boiler check valves, blow down cocks and bye-pass valves etc. from firms specialising in the manufacture of such fittings. One such firm was Robert Harlow and Son of Stockport, Cheshire, and I have in my possession their catalogue of 1901, every page of which carries illustrations of all types of boiler and engine fittings together with most elegantly designed and executed Suet Lubricators, Tallow Cups, Down-Drop sight feed lubricators and many other beautifully cast gunmetal fittings, the use of which has long passed into history. Unlike many other firms, Ransomes appeared to prefer casting their own fittings — excepting of course, such specialist things as water gauges etc. — and most of the steam and water fittings on the steam tractor are drawn up on their official works drawings for manufacture within Orwell Works.

This, from the point of view of the model engineer, is rather a mixed blessing as it precludes the use of the neat compact fittings now available "over the counter" if one is to keep strictly to the character of the prototype in all these smaller details. To give builders of the two inch scale engine some degree of choice in the matter, I am including a few illustrations taken from the works drawings supplied to me by the Institute of Agricultural History at Reading while at the same time

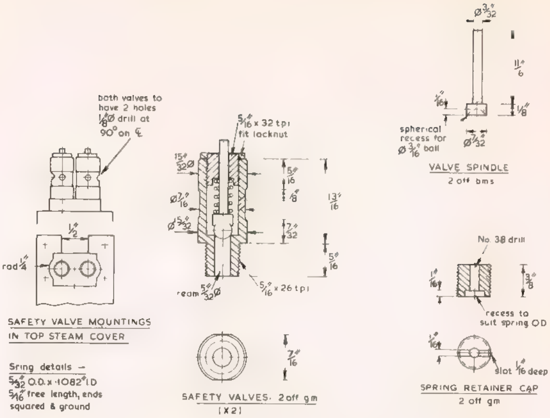


PUMP DRIVE STUB: 1 off b.m.s.

Note:— Pump attached to hornplate with 2BA set screw into front hollow stay & 2 steel dowels.

Pump gear details:—
CRANKSHAFT GEAR: 1 off steel
1" P.C.D. 1·100" O.D. 20 teeth ¼" wide x 20 D.P. 20° pressure angle.
Boss Ø ·845" x ¼" wide ½" bore

PUMP DRIVE GEAR: 1 off steel
1·500" P.C.D. 1·600" O.D. 30 teeth ¼" wide x 20 D.P. 20 D.P. 20° pressure angle, 3/8" bore.
To run freely on stub, pinned to pump eccentric with 3/16" pin.



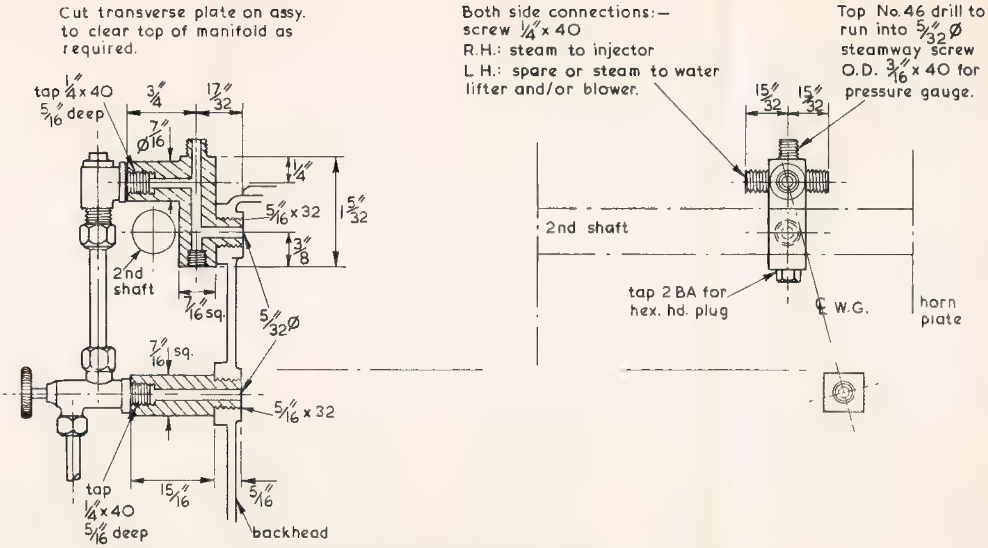
specifying the ready made and easily obtainable fittings now available.

With both pump and one injector available for boiler feed I am not fitting a hand pump but should any reader wish to include one, the tender, although limited for space, is the only place available where it will not look too out of character and can be easily operated. Among the items still to be drawn and described the canopy roof or awning is the largest; here again we have a choice of long or short roof, both types having featured in the photographs accompanying these articles. The short awning is supported at the rear of the tender and the forward end of the hornplates with a couple of sloping stays bracing these front columns.

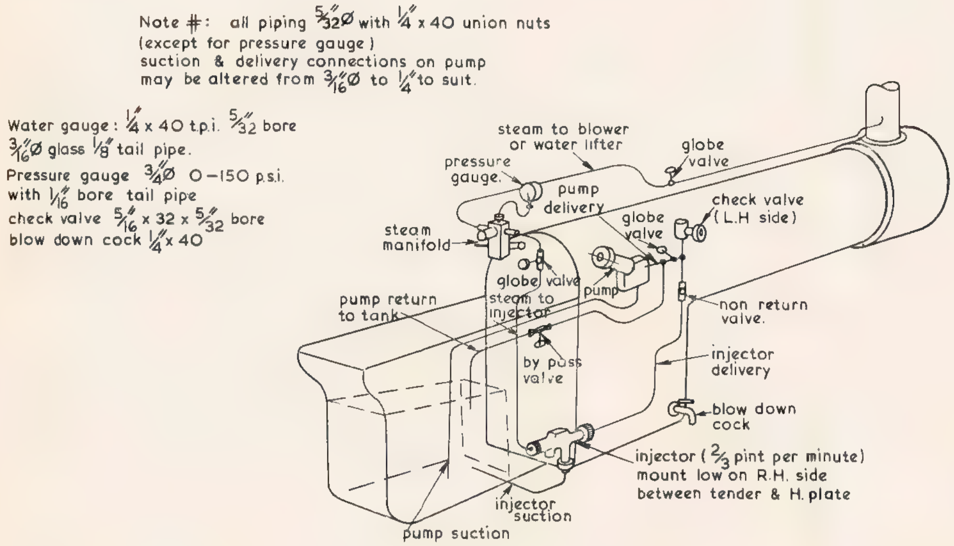
The long full length awning stops short just behind the chimney with a single column running up from the front of the cylinder casting to the centre of the roof, both types having fairly deep side boards and shaped front and back end-boards.

The original awnings had felt laid over wooden rafters, but I prefer the wooden awnings, as fitted to the surviving engines of the class and intend to fit the short version on my own engine, leaving the cylinders and motion in the open, although even then the latter is largely concealed behind motion covers.

Despite the shelter provided by a "top" not all drivers liked them many claiming that they were too hot in summer and tended to be noisy and rather restrictive and while common on the vast majority of road engines they were rarely to be seen on ploughing engines and general purpose agricultural engines engaged on the threshing and other farm work, and even some road rollers were to be found without the usual awning, mainly in rural areas. It will be quite possible to follow full size practice as regards construction of the awning if a fairly stiff grade of roofing felt is used and secured directly on to the roof cross-members and longitudinal battens, after prestretching over the curved wooden members. With both sides of the felting secured tightly down behind the facia boards each



WATER GAUGE & MANIFOLD



PIPING LAYOUT (diagrammatic)
water gauge not shown.

side of the awning the surface should be reasonably smooth and even but great care is necessary to avoid even good quality felting from cracking along a line just inside the facia boards.

Having had some unfortunate and wastefully expensive experiences with roofing felt stretched directly over wooden beams and battens, I am not anxious to risk unsightly sagging even in two inch scale and am building the awning of my engine with the correct number of cross members and longitudinal battens or runners, but with the thinnest grade of smooth felting secured by the correct felting adhesive directly onto a 20 s.w.g. curved m.s. sheet between the facia boards, forming the roof proper.

This way there is no chance of those unsightly sags and wrinkles appearing in the felting between supports and I think the whole assembly will look much neater than felt on its own, stretched over woodwork. *To be concluded*

"HOLMSIDE"

A 0-6-0 tank locomotive for 7¼ and 7½ in. gauges

by Martin Evans

Part XII

From page 343

NEARLY ALL the chassis components for *Holmside* have now been described, but there is still the cylinder drain cock gear to make. This is very similar to the arrangement recently described for *Greene King*, and in fact for many other locomotives in this series, though it is of course considerably more robust, as befits an engine intended for hard work on a ground level track.

The cock bodies themselves can be made from drawn gunmetal or phos-bronze bar, ⅜ in diameter, in which case stainless steel would probably be the best material for the plug cocks. To cut the tapered hole in the cock body, a quick way is to drill right through with a No. 34 drill and follow this up with a No. 00 standard taper reamer. (This size is 0.112 in. dia. at the small end and approximately 0.150 in. dia. at the large end.) The plug cocks can then be turned to suit.

To obtain the right fit of the plug cock in the body, two No. 8 BA nuts are suggested, which can be locked together when adjustment has been carried out. The cock levers, made from brass or nickel-silver, have a squared fitting on the large ends of the plug cocks, and are soldered to them.

The cock connecting rods are cut from ⅛ in. thick b.m.s. and work on pins turned from 5/32 in. steel hexagon. Alternately, these pins could be turned from ⅛ in. dia. silver-steel, and threaded at both ends to take 6 BA nuts.

A cross-shaft of 5/16 in. dia. b.m.s. is used, turned down to ¼ in. dia. at the ends to take the forked levers (C) in my drawing. This is fitted immediately below the cylinders, where the appropriate 5/16 in. dia. holes will be found in the frames. To rotate this shaft, a further 5/16 in. shaft (B) is fitted across the frames, near the top edge and to the rear of the smokebox. This carries a fork joint (F) threaded 3/16 in. x 40t. for the 3/16 in. dia. operating rod, which runs at first just inside and above the left-hand frame, for the first inch or so, and then immediately above the top edge of the frame to the control lever in the cab. The intermediate link (E) of ¼ in. x ⅛ in. section, is arranged well inside the frames, so as to clear the left-hand steam chest. If stops are preferred, to ensure that the plug cocks are not rotated too far in either direction, these could be very easily fitted on each side of the cab lever.

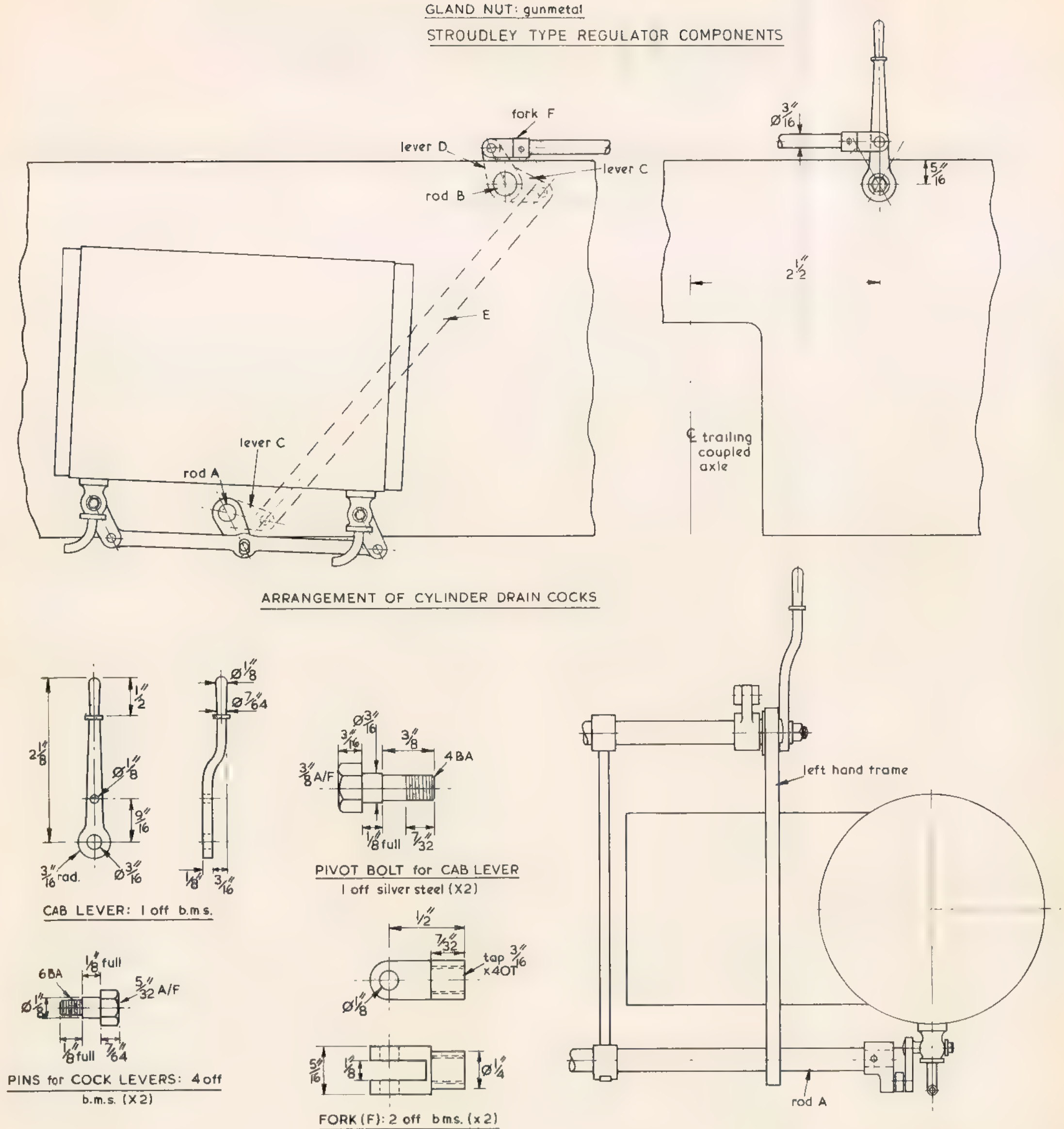
The saddle tank

A non-ferrous metal is almost essential for the construction of the saddle tank. Tinplate might be considered, but the trouble with tinplate is that it goes rusty very quickly at the edges, or wherever it is cut. Another suggestion is to make the tank entirely of steel and have it galvanised. However, I cannot really recommend either material, and in spite of the present high costs of brass, I fear that brass is almost essential here. 18 s.w.g. brass will be plenty strong enough, as this can be thickened locally wherever bushes etc. are required; a central "bulkhead" is also provided.

As will be seen from the drawings, the saddle tank fits over the barrel of the boiler after this has been lagged and cleaded, and fitted with the boiler bands. The drawings show both the details of the boiler bands, for which brass is quite satisfactory, and their positions along the barrel. Note that the ends of the bands, where they are bolted up underneath, are strengthened by short pieces of the same section, which can be riveted or silver soldered on. The ends of the bands are best annealed before bending.

If the saddle tank is a nice fit over the completed barrel, it will not need a great deal of fixing, and I think that the three pieces of brass angle shown will be sufficient to hold things in place. At the front end, a 1 in. length of 5/16 in. angle is used; it will require bending to the radius of the smokebox, but this should be easy enough with such a short piece; it is held down by three 6 BA bolts, into tapped holes in the top of the smokebox. At the rear end, two pieces of ⅜ in. brass angle are used, again 1 in. long. These bolt to the spectacle plate. In this case, the bolts could be put through from the inside of the cab, with nuts on the tank side.

Some kind of "balance pipe" is essential in tank engines, so that the water level is always the same on each side of the locomotive. This will have to be attached after the boiler has been permanently fitted to the frames, so the screw holes in the flanges should be placed so that it is not too difficult to get a spanner into position. The balance pipes are made from ½ in. x 16 s.w.g. copper tube, well annealed before bending of course, and the flanges, of 1 in. dia., are silver soldered on each end. 18 s.w.g. material is too thin to take a thread, so the bottom of



STROUDLEY TYPE REGULATOR COMPONENTS

ARRANGEMENT OF CYLINDER DRAIN COCKS

CAB LEVER: 1 off b.m.s.

PIVOT BOLT for CAB LEVER
1 off silver steel (X2)

PINS for COCK LEVERS: 4 off
b.m.s. (X2)

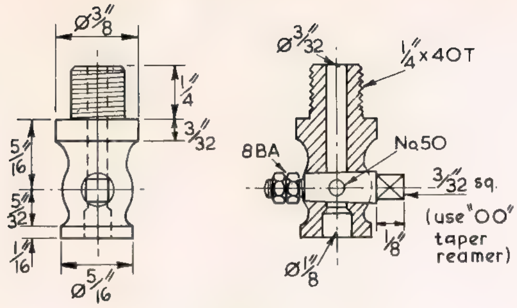
FORK (F): 2 off b.m.s. (x2)

the tank to which the pipes are attached should be stiffened by soft soldering on the inside a brass plate about 1½ in. x 1¼ in. and 1/16 in. thick; this being done before the ends of the tank are fitted.

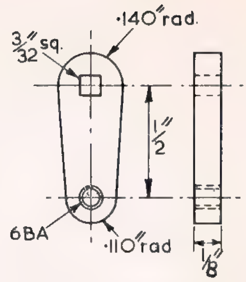
At the rear end of the tank, we require some kind of water gauge, to show the level of the water, and this could be of the usual locomotive type, though a blow-down is not needed. A gauge with a glass ¼ in. diameter will do nicely, though the glass should be protected against accidental damage by some kind of hinged plate, which can be swung out of the way when a reading is required.

Two water cocks for the injectors are also required, one on each side, so tapped holes should be provided for these in the positions shown. Once again, the 18 s.w.g. plate should be well stiffened on the inside, this time ⅛ in. brass sheet being used, to give plenty of depth to the threads.

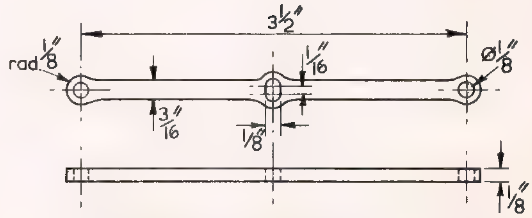
The cab front plate, or spectacle plate, is made from 1/16 in. steel or brass. It is made in two pieces, with the join down the middle as usual. Builders of the 7½ in. gauge version will not however need this join. This is because the firebox for the larger gauge engine is not "waisted in", being the full 6 in. wide. Therefore, the spectacle plate can be "slid" into position from above.



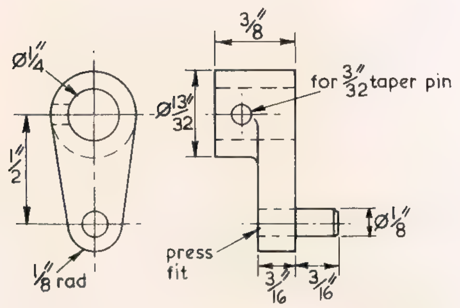
CYLINDER DRAIN COCK: (X2) body gunmetal plug cock stl. steel.



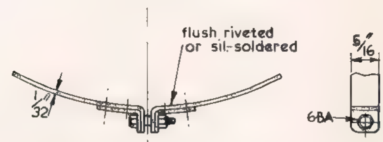
COCK LEVER: 4 off brass or nickel-silver (X2)



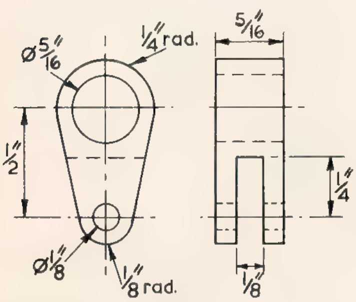
COCK CONNECTING ROD: 2 off b.m.s.



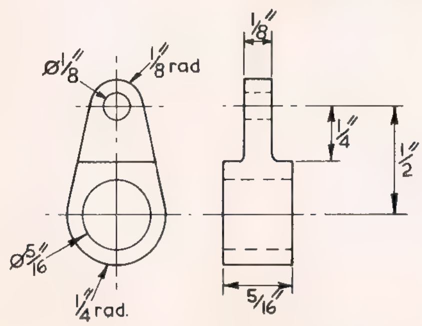
OPERATING LEVER: 2 off b.m.s. pin sil. steel (X2)



DETAIL OF BOILER BANDS



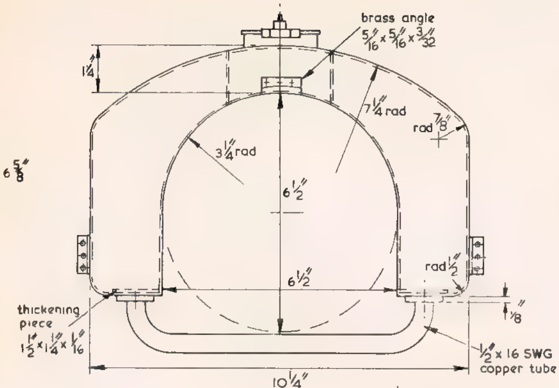
FORKED LEVER: (C) 2 off b.m.s. (X2)



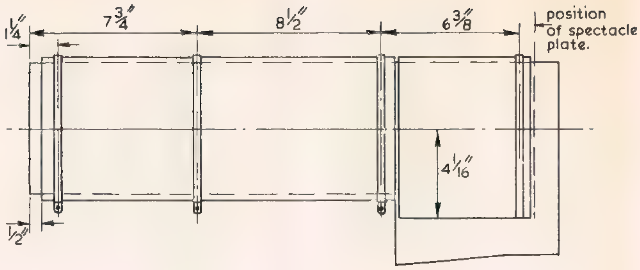
LEVER: (D) 1 off b.m.s. (X2)

Holes ⅝ in. dia. are required in the spectacle plate, to clear the water gauge and the two water cocks. The "spectacles" or driver's lookout windows should be glazed, using standard window glass, which in this small diameter should be quite strong enough. The glass is held in position by two brass rings, cut from 1/16 in. sheet. They are held in position by 12 BA brass roundhead screws. If the outside ring is polished, this should give the cab a nice finishing touch.

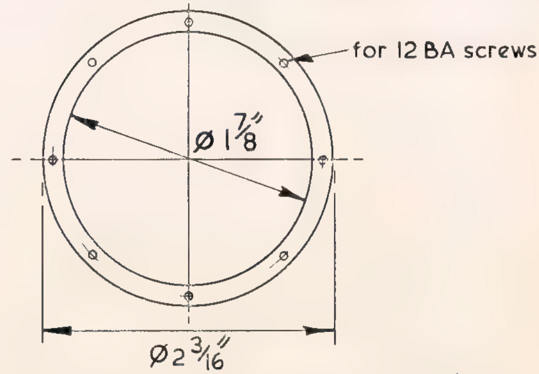
Returning to the question of the lagging of the boiler barrel, as asbestos sheet is not too popular nowadays, and in any case is messy stuff to work with, I suggest that several layers of steam sheet packing material might be used, somewhat expensive I admit, but nice stuff to handle, especially the "Walkerite" sheet, which I prefer to "Hallite". Five thicknesses of the 1/32 in. thick sheet should be about right, though I would suggest that only four thicknesses should be tried at first, and then



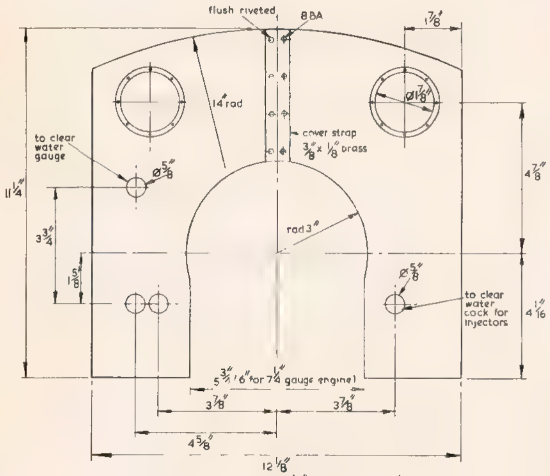
FRONT OF SADDLE TANK (1/2 FS)



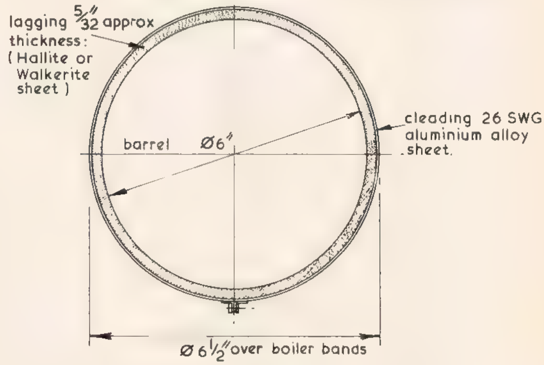
POSITIONS OF BOILER BANDS (1/4 FS)



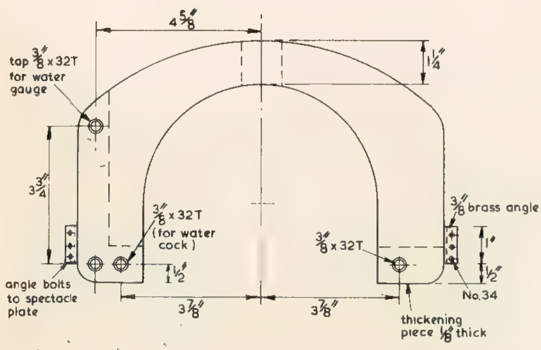
SPECTACLE FRAMES: 4 off brass 1/16 thick



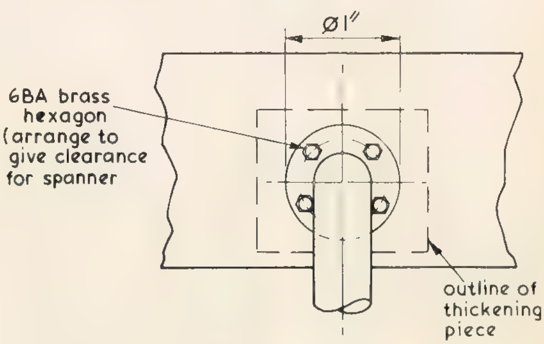
SPECTACLE PLATE: 1/16 steel or brass (1/2 FS)



LAGGING & CLEADING DETAILS (1/2 FS)

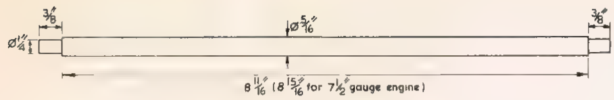


REAR OF SADDLE TANK (1/2 FS)

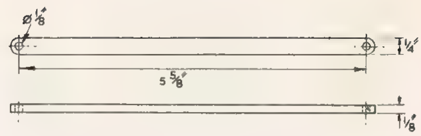


DETAIL OF BALANCE PIPE FLANGE

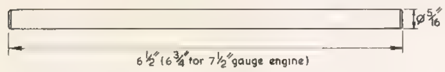
(from underside)



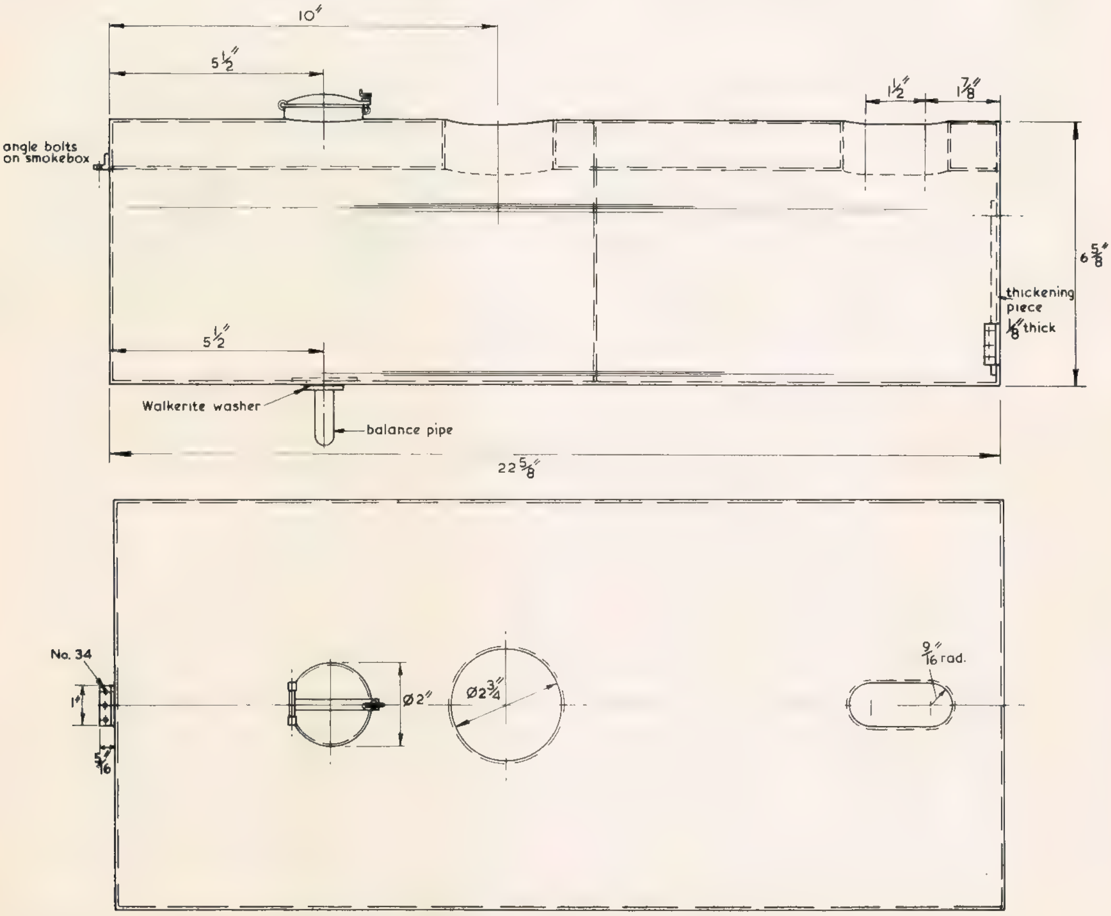
CROSS ROD (A) FOR DRAIN COCKS: 1 off bms



CONNECTING LINK (E) FOR DRAIN COCKS: 1 off bms



CROSS ROD (B) FOR DRAIN COCKS: 1 off bms

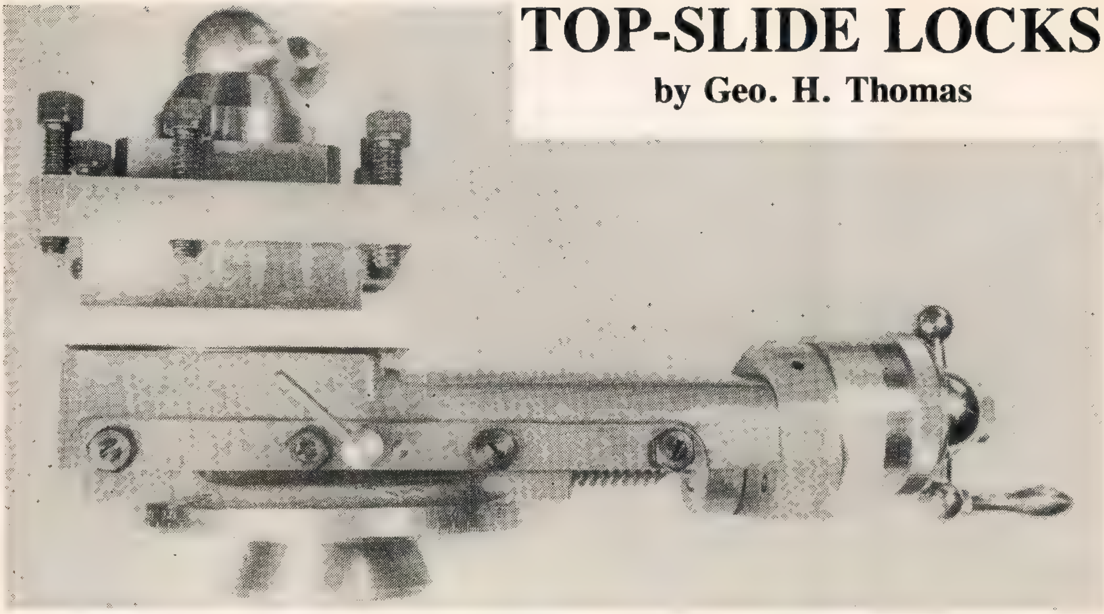


SADDLE TANK 18 SWG. (half size)
(see sheet one for steps & handrails)

the cleading of 26 s.w.g. aluminium alloy sheet be rolled up, and the boiler bands tried in place. If the overall diameter is approximately 6½ in., which is what we require, the fifth thickness of lagging will not be required.

It may be asked why I am suggesting aluminium-alloy sheet for the cleading, instead of the more usual brass. The answer is that this metal is not such a good conductor of heat as brass, and this could well be an important point, as we are relying on injectors for keeping up the water level, and if the water in the saddle tank gets too hot, the injectors may well fail to function. Of course steel of the same gauge might be used instead of aluminium, especially if it was well protected against rusting. The material known as C.R.C.A. (cold rolled, close annealed) can generally be obtained from steel stockholders in 26 s.w.g. Although harder to bend, it should not be difficult with this quite thin gauge.

Details of the steps and handrails are not shown on my drawing of the saddle tank, but these can be located from the general arrangement drawing, published with the first article *To be continued*



TOP-SLIDE LOCKS

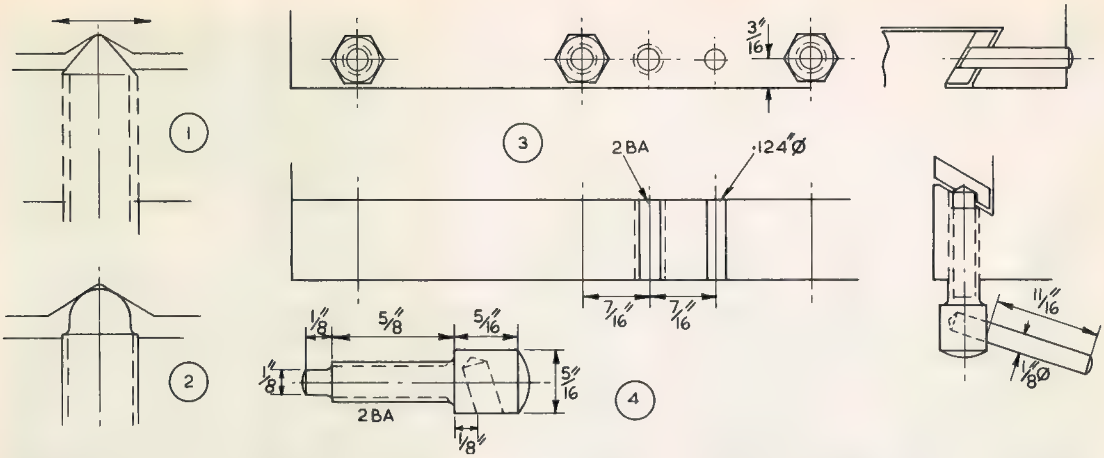
by Geo. H. Thomas

I HAVE BEEN INTENDING to contribute a few words on the subject of slide-locks for quite some time and this short article is a slightly expanded form of some notes on the subject which I prepared for some readers who had asked for information after having noticed a little lever on the front of top-slides which were shown in some photographs. Some recent correspondence in which a reader elected to misinterpret everything I said on the subject has prompted me to get on with the job.

I have, more than once, had occasion to remark that top-slides and, more particularly, vertical slides should be provided with some simple locking means as a safeguard against accidental movement of the handle and also to prevent creeping under vibration when operations such as milling are in progress. The feed-screws on many of our small lathes are small in diameter in comparison with their pitch with the result that we frequently have mean helix angles of about 6°. If the friction in the end bearings of the screw is reasonable, a screw of this lead angle will tend to turn under vibratory or intermittent loads and it is for this reason that it is advisable to lock the slide. Some people tighten one of the gib-screws but this is a poor way out of the difficulty; there is no point in disturbing adjustments which have, we hope, been carefully made.

Before proceeding to the actual work of making and fitting a lock, there is one other matter which I consider to be of great importance, namely, the dowelling of the gib-strip. The usual arrangement is for the gib-strip to be held into contact with one side of the dovetail slide by means of pointed screws which touch the bottoms of dimples as shown at (1). These would be quite effective if the slide never had to move but movement is what the slide is for! When the slide is wound along in either direction, the frictional drag against the gib-strip will produce a wedging action at the tips of the screws which will, in turn, tighten the slide. There have been many complaints on this score from readers in the past and the remedy is a simple one — fit a dowel into the gib-strip and so prevent any end movement in relation to the screws. It will be apparent that this end movement will cause bruising and wear on both the screws and the dimples with the result that the slide will need to be re-adjusted more frequently than would otherwise be the case. For some years now Myfords have used screws with hemispherical ends which are a step in the right direction but a dowel is the simple, and complete, answer. I would like to qualify the word "simple"; the operation is simple enough for you and me but it does not readily lend itself to quantity production methods.

All dovetail slides are, or should be, so arranged that the major cutting forces are taken by the solid shears which form, in effect, the master sliding surfaces. The opposite side is provided with the means of adjustment. The adjustable gib, whether strip form or solid type, on a cross-slide is on the tail-stock side — the headstock side carries the cutting load. All this being so, the lock should be on the same side as the adjustable gib because if it were on the other side it would tend to separate the "master" surfaces and transfer the locking pressure to the tips of the gib screws which would appear to be highly undesirable. The lock is not always used to hold the slide firmly against movement, sometimes it can with advantage be used to increase resistance



to movement when taking light "climb-milling" cuts or breaking out of the end of a slot with an end-mill. (See "End-mills and Slot-drills" vol. 143.)

Although the following details and dimensions apply specifically to the Myford Super-7 lathe they would almost certainly cover the ML7 and ML7R lathes and, with minor modifications, many similar sized lathes of other makes. As many owners of lathes, especially newcomers to the "cult" with new machines, might be reluctant to make modifications to, or drill holes in, their lathes — in case something goes wrong — I will give full and exact details, step by step, of the operations involved.

1. Remove the slide from its base and remove the endplate complete with the feedscrew.

2. Mark out for the two holes in the slide (see 3). Drill 9/64 in. dia. (or No. 29 or 28 or 3.5 mm.) for the 2 BA hole and No. 32 for the ⅛ in. hole, passing the drills right through and with care as you break through the 30° face. Perhaps the best way to hold the slide for this operation is to clamp it to an angle-plate — sliding surface to the plate — using a toolmaker's clamp or one borrowed from the woodworking department.

3. Replace the slide on to its base with the gib-strip properly fitted and, using such means as you have available to hold the assembly in the correct position, (I found that a drilling machine vice did the job) drill down through the 9/64 in. (or equivalent) hole to form a shallow dimple in the gib-strip, feed down *not more* than 1/16 in. after first touching the steel.

4. Tighten one of the gib-screws to prevent the slide from moving and then drill through the No. 32 hole, through the gib and into the C.I. base a short way, say ⅛ inch. This hole in the base is not required for any particular purpose but it does enable us to drill a clean hole through the inclined gib-strip. The short hole in the C.I. member does no harm — in fact, it might hold oil.

5. Before disturbing anything, follow the No. 32 drill with a 3.15 mm. drill. This is a very useful size of drill as it is .001 in. smaller than ⅛ in. Between Nos. 31 and 30 there is a step of 8½ thous but there are five metric drills in this important gap. Regarding the 3.15 mm. drill, don't believe anyone who tells you that they are not made — they are! Mine are by Dormer and Presto.

6. Strip down and open the 9/64 in. hole to No. 22 and tap 2 BA.

7. Whilst running in the lathe, stone down the end, for about 3/16 in., of a piece of ⅛ in. silver-steel. Go very gently, it should just fit the hole in the gib-strip. File the end to 60°.

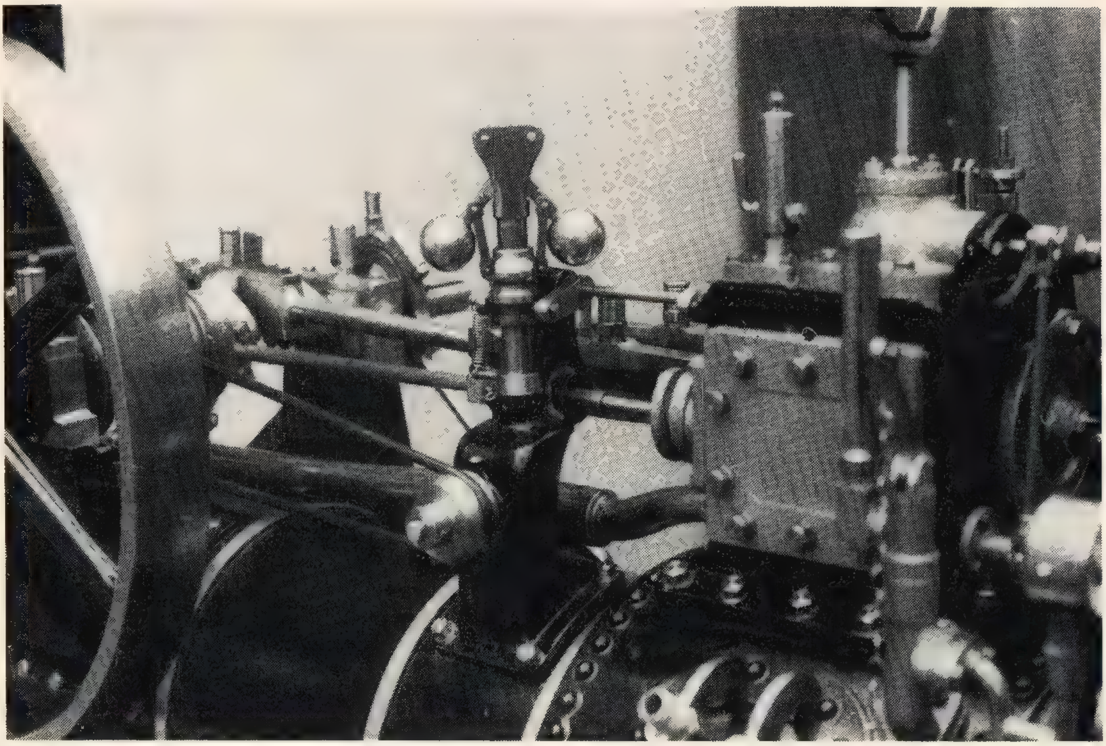
8. Cut the dowel to length and round and polish the outer end. The correct length can be determined most easily by slipping the slide part-way on to the base and resting the silver steel against the end of the slide with the angled end touching the dovetail at about mid-height.

9. If the dowel is too tight in the hole in the slide, and it might well be so, ease the hole a little with a ⅛ in. hand reamer but do *not* push right through or the dowel will be too loose. The finely tapered end of a hand-reamer will leave the bottom of the hole tight on the dowel. With the angled end turned the right way, drive the dowel in but not quite far enough to touch the dovetail.

10. Make screw (4). Fit and tighten in place with everything correctly assembled; a pair of pliers with brass or german-silver lined jaws is useful for this kind of job as they do not mar finished work. (Another job for the odd half-hour). Mark on the head for a ⅛ in. hole a little anti-clockwise of upright. Remove the locking screw and drill at about 15° to 20° off square and fit the ⅛ in. silver-steel handle.

11. Fit and adjust the gib-screws before replacing the feed screw. It is so much easier to obtain a correct sliding fit overall without the screw in place.

12. Replace screw and endplate leaving screws slack until the feedscrew is right home as far as it will go. Then tighten the endplate screws.



Close up of governor bracket and mounting. *Photo — Arnold Throp*

THE MARSHALL PORTABLE ENGINE

Part XI

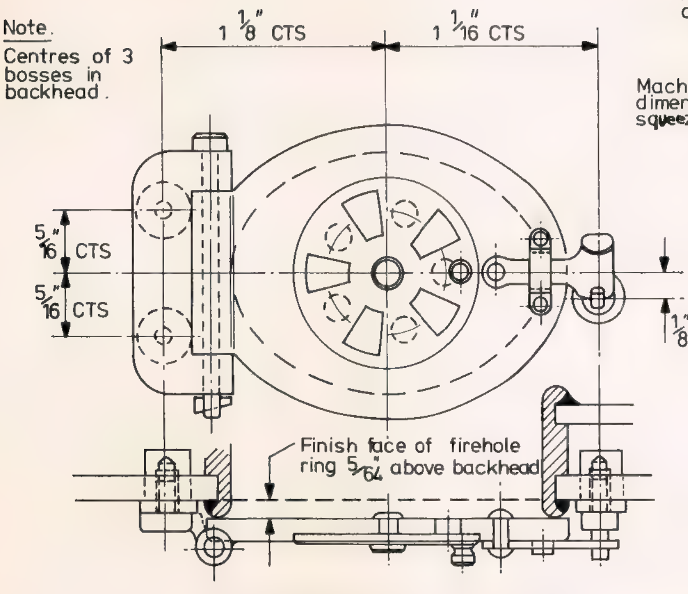
by Ron Kibbey

Continued from page 379

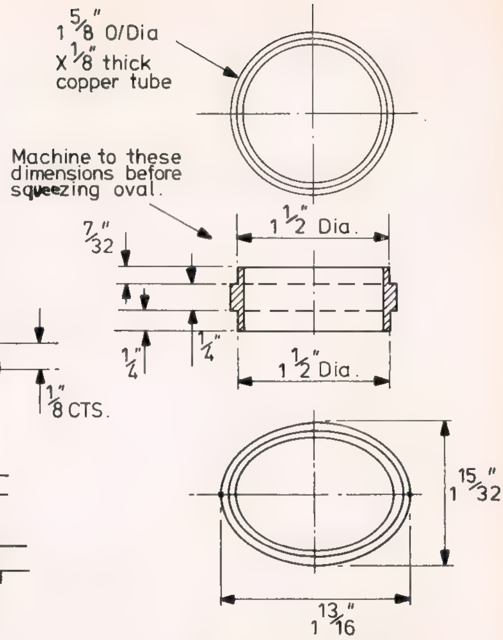
NOW THAT ALL the components required in order to mount the cylinder and motion on the boiler shell have been covered, most builders will no doubt want to go ahead and complete that stage. In his second article, Bill advised "part building" the boiler, which he defined as the outer shell but without firebox and front tube plate, and with the backhead secured in place with a few bolts. This gives a "chassis" on which to line up and secure the cylinder and motion whilst retaining access to the interior during this operation. I am assuming that this advice will have been taken.

However, before describing the method I used to mount the motion on the boiler shell, I feel I should draw attention to a further correction to Bill's boiler details. On H.S.20 Sheet 2 and *M.E.* Vol. 142, page 806, the tube required for the fire hole ring is specified as 1½ in. O.D. x 10 G copper tube. When purchasing my boiler material from Reeves I was advised to use 1⅝ in. O.D. x 10 G tube for this ring, and I assume other builders using the same supply source will have been similarly advised. I have, therefore, included in this instalment the dimensions of the ring in its final shape, together with the centres of the hinge and latch bosses which were not specified on H.S.20 Sheet 3. These three bosses should be made shorter than shown on H.S.20 Sheet 3, the ½ in. length being reduced to 5/16 in. in order to clear the inner firebox rear plate. Details of the firehole door itself are also covered.

It is very obvious to anyone studying the construction of this engine that the "trickiest" part of the job is getting a good line-up of the cylinder block, motion bracket, crankshaft and governor bracket and, however accurately these components may have been machined, if the boiler shell deviates in size or geometry from the drawings trouble will be experienced. The positioning and securing of the crankshaft bearing brackets on the boiler shell was covered in some detail in Part 3 of



ARRANGEMENT OF FIRE HOLE DOOR



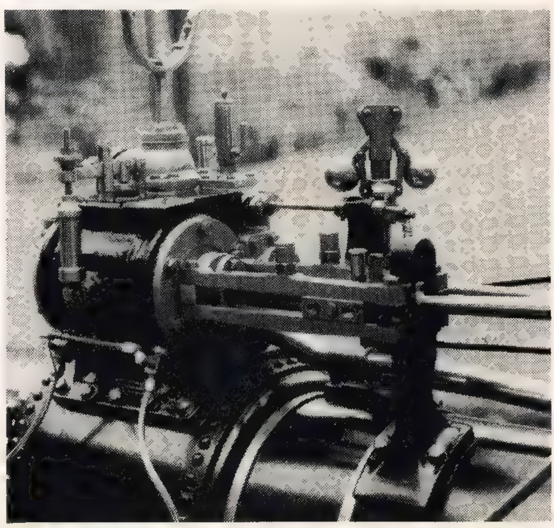
DETAIL OF FIRE HOLE RING

Note : This ring is 1/8" larger in Dia than that specified on H.S. 20 sht 2 as recommended by Reeves

the series by Bill. Some datum surfaces are required on the boiler shell, for subsequent lining up of the motion. The boiler shell should be stood on a surface plate or other reasonably flat surface, a piece of plate or float glass will be sufficiently flat for the purpose. The bottom edges of the box outer wrapper should be trimmed if necessary in order that the sides of the wrapper are vertical, and the underside of the boiler barrel should be blocked up so that the boiler is horizontal and the crankshaft journals horizontal in the end elevation.

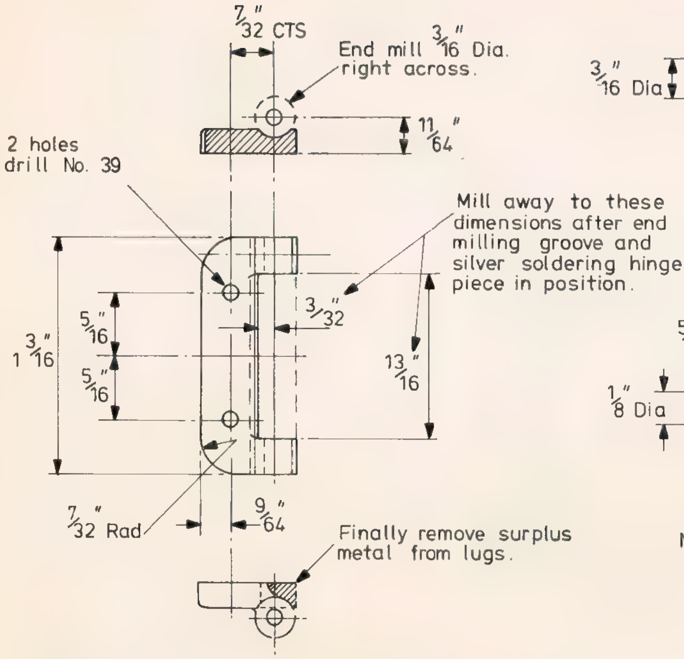
Before offering the cylinder block to the boiler, make a close fitting plug for the cylinder bore about 1½ in. long and mount centrally in it a 13/32 in. dia. silver steel bar about 8 in. long. With a further length of silver steel of this diameter in the crankshaft journals, we have a means of ensuring that the cylinder bore is both square with the crankshaft centre line in plan view and in line in the side elevation. Do not overlook the fact that the fore and aft centre line of the cylinder block in the side elevation is 1/16 in. forward of the centre of the firebox wrapper, and in the end elevation the centre line of the cylinder bore is 1 in. from the boiler centre line. Having found the best position for the cylinder block to obtain this alignment with the crankshaft axis, clamp the cylinder block to the wrapper with a pair of tool makers' clamps (remove back head for this purpose) — do not drill and tap for securing screws yet.

Next, remove the plug and bar from the cylinder

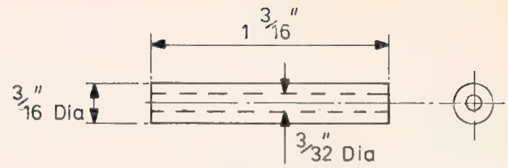


Cylinder block/motion bracket. *Photo – Arnold Throp.*

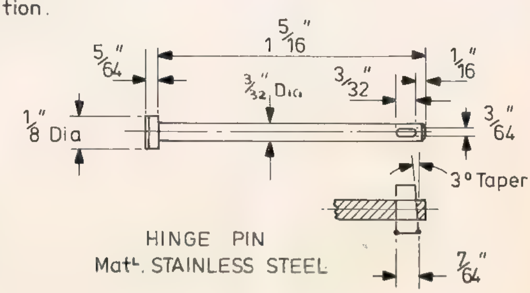
block and fit the front cylinder cover with guide bars attached and with piston, rod, and crosshead fitted. With the crosshead in the forward position, offer the motion bracket to the boiler barrel and check the alignment of the front ends of the slide bars with the bosses on the bracket. With a piece of ⅛ in. silver steel in the valve rod bore and a suitable loose bush in the governor bracket bearing bore, the alignment of the governor bracket can now be



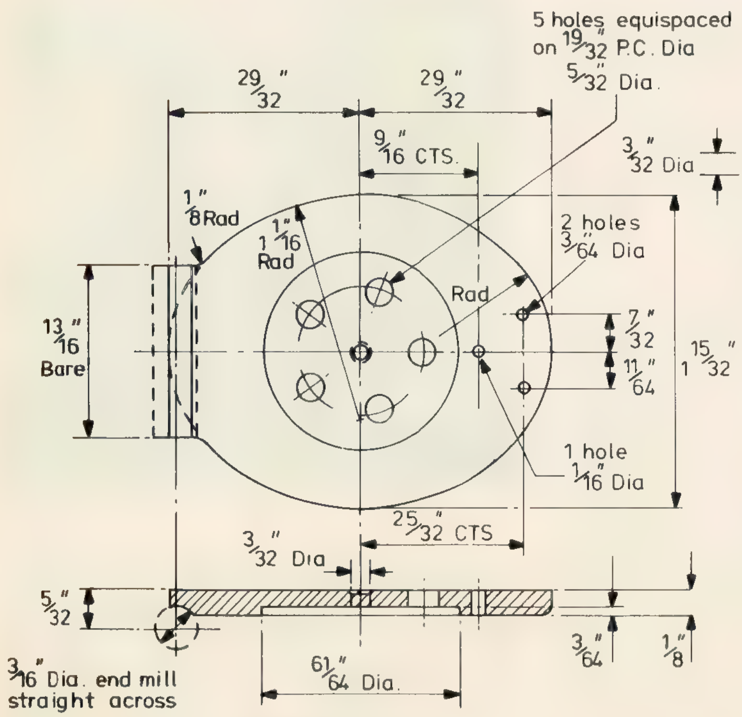
BRACKET - FIRE HOLE DOOR
Matl. STAINLESS STEEL.



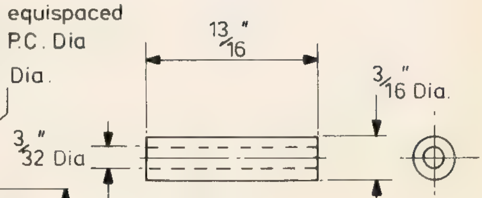
HINGE PIECE
Matl. - STAINLESS STEEL.



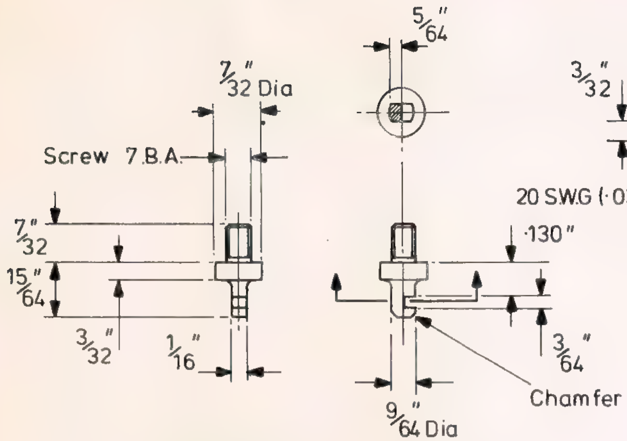
HINGE PIN
Matl. STAINLESS STEEL



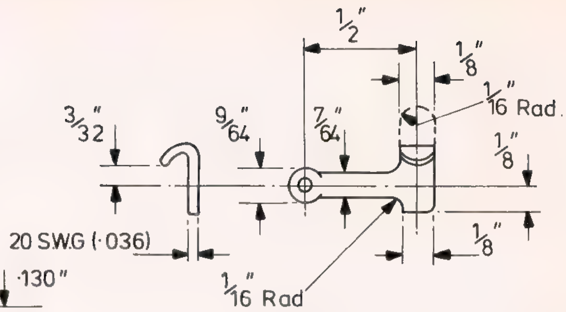
FIREHOLE DOOR
Matl. STAINLESS STEEL.



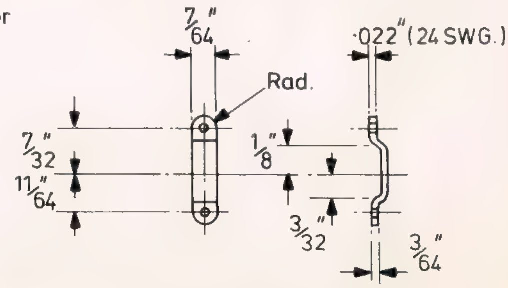
HINGE PIECE
Matl. - STAINLESS STEEL
SILVER SOLDER TO DOOR.



LATCH - FIRE HOLE DOOR
Matl. STAINLESS STEEL.



LATCH PLATE
Matl. STAINLESS STEEL.



KEEP PLATE
Matl. STAINLESS STEEL

checked and also the alignment of the 3/32 in. holes in cylinder block and governor bracket for the governor valve operating rod.

Mind you, it is one thing to check for alignment of these components, but what does one do about it if considerable misalignment exists on these checks?

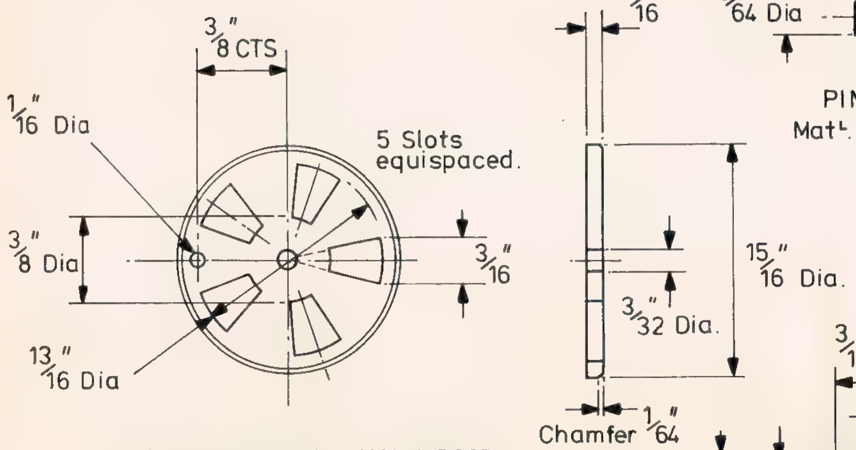
The copper of the firebox outer wrapper will, of course, be quite soft after the brazing operation and some manipulation of the area on which the cylinder block sits will be possible to correct minor alignment errors. Secondly, a "Walkerite" or "Hallite" type of jointing material under the cylinder saddle could be used up to say 1/32 in. thick, which would also assist in making a steam tight joint. Similarly, a piece of copper or brass sheet under either the governor bracket or the motion bracket mounting flanges could be used. Certainly do not attempt any major correction by distorting the boiler shape except for very minor adjustments of a few thous, and remember that the squareness of the cylinder bore centre line with the crankshaft must be retained and also its alignment in the side elevation.

Without any distortion of the boiler I obtained good alignment of all components with the exception of the front motion bracket, which required a piece of .028 in. thick material under its mounting flange to bring the guide bars into true position.

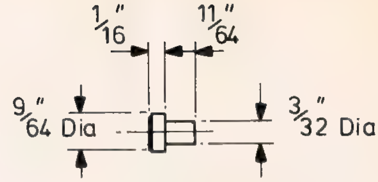
Because the screws for securing both the cylinder block and the brackets break through into the steam space, there are potential leak points here, and the screws should be made from phosphor bronze or gun metal or Monel metal. Brass or stainless steel are not suitable because of dezincification and electrolytic corrosion. This will, no doubt, mean making one's own hexagon headed screws. When a seal has to be made at the screw head, I find that a slight coning of the underhead face of the screw head (about 15° to 20° from square) helps make a seal and, of course, the threads coated with a suitable sealing paste.

When the components are fully screwed down into position, a final check on the alignment of the cylinder bore with the crankshaft should be made. Having achieved an acceptable assembly of the motion components, these should be removed and the boiler making completed.

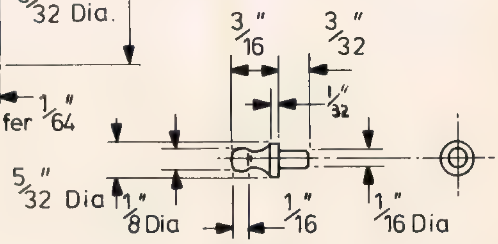
When carrying out the further assembly and silver soldering operations on the boiler, extra care should be taken to guard against distortion of the shell shape, either by mishandling or by pickling through quenching from too high a temperature. Heating copper will not cause distortion, but a rapid immersing in a cold bath from little short of silver soldering temperature certainly will. Also bear in mind that, whereas with a rail locomotive, badly formed joints and surface defects can be covered by cleading, on this engine the firebox wrapper remains open to inspection on the finished engine, and therefore much neater "boiler smithing" is essential for cosmetic reasons, apart from the boiler being the "chassis".



AIR VALVE - FIRE HOLE DOOR
Matl. STAINLESS STEEL

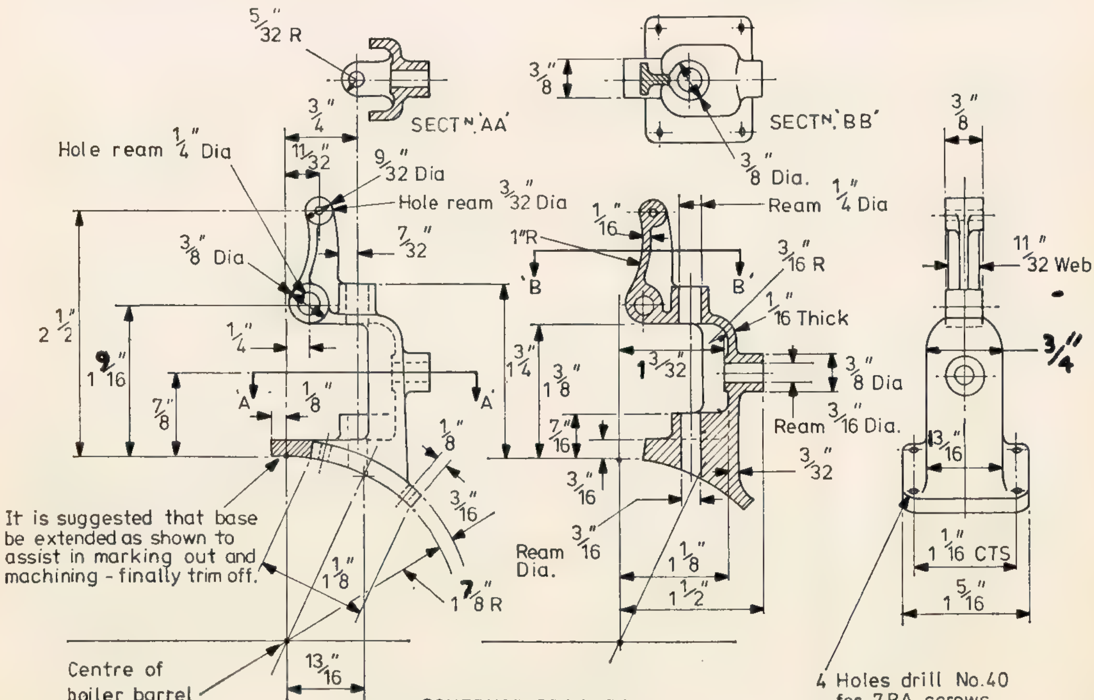


PIN - AIR VALVE
Matl. STAINLESS STEEL



KNOB
Matl. STAINLESS STEEL
Lightly rivet into air valve

In the next instalment, I propose to cover the rear axle and the front undergear and axle. When this is followed by the wheels we shall then be "standing on our own feet" as it were — a stage which I found particularly gratifying.



GOVERNOR BRACKET
Matl.-BRONZE OR GUN METAL CASTING.

Reprinted from Part X due to dimensional errors in tracing.

THE PISTON DROP VALVE ENGINE

Part I

by A. Haworth

SOME SHORT TIME AGO, I submitted a brief article in which I discussed a model cross compound mill engine with inlet drop valves. On the cylinder I showed a single beat valve, and in the article I made it clear that I did not consider such a valve was entirely suitable for its purpose and the valve would not be used in a full sized engine. It is unbalanced, which again I pointed out, and a seated valve which seats and unseats up to 100 times per minute cannot be regarded as ideal, but it would be suitable for a model which does not have to work 60 hours per week. The ideal valve is one which is in equilibrium, however, I think we should present both sides of the same picture.

The valve eminently suitable for this purpose is the piston drop valve. It is much more difficult to make, again as I previously stated, and also requires a more complicated cylinder, but you cannot have it both ways. The valve, see drawing, is in perfect equilibrium. That is to say it sustains the same steam load top and bottom and it possesses no seats as such. The GM valve works in a rustless steel ported liner so that good and accurate workmanship is essential.

The valve lifts to open and drops to close, hence its name. It is operated by trip gear, already described, and needs to be as light as possible since the trip gear has to lift it. The spring ensures closure at valve release. It is observed that, where the spindle emerges through its bonnet bush, no stuffing box or packing is used. The arrangement is one which is known as a "labyrinth" packing, and works on the following theory. A number of grooves are machined on the valve spindle, the exact number and shape being immaterial. Let us say that the steam pressure at the spindle is P. This pressure is trying to force itself up between spindle and bore, and of course it does precisely that.

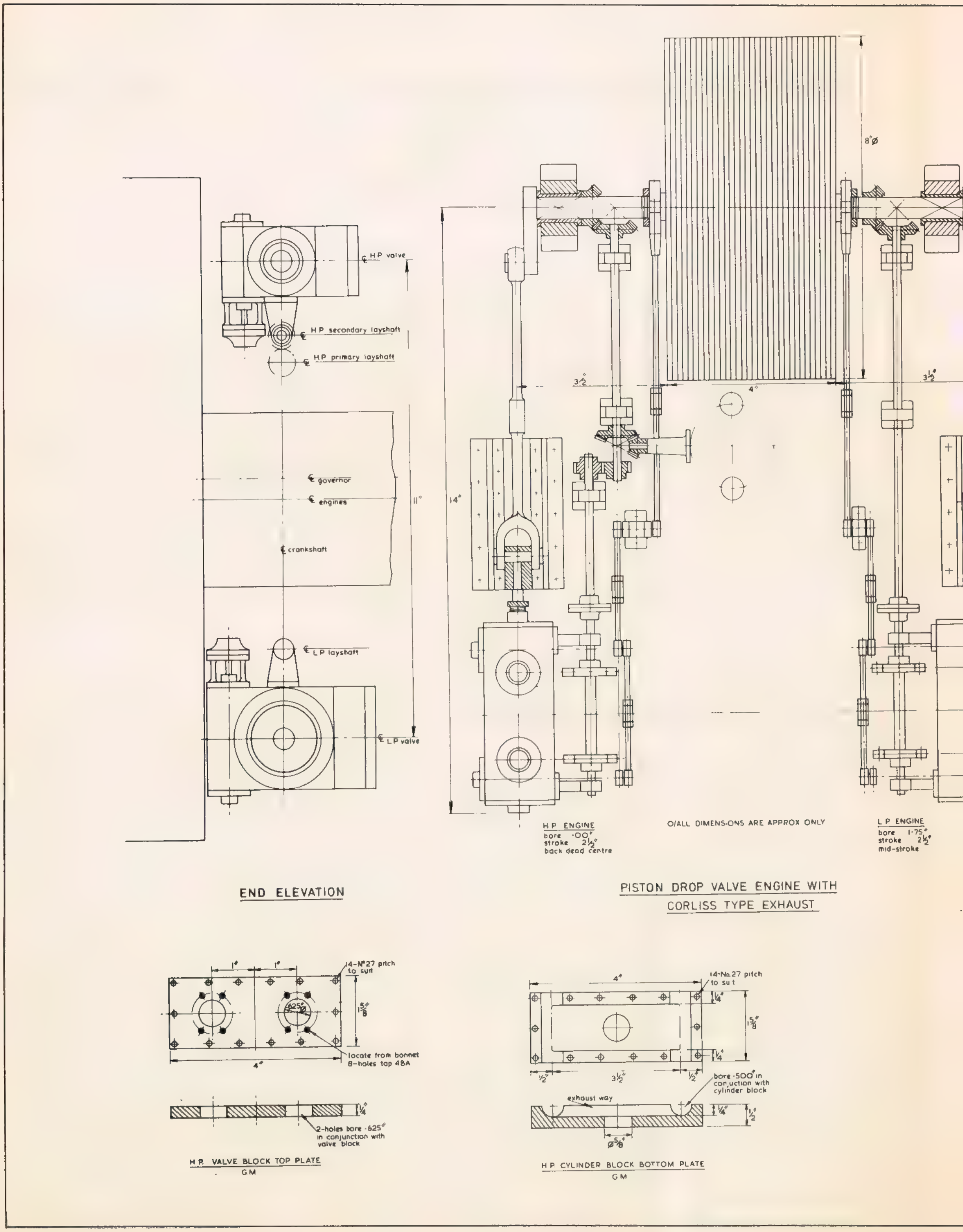
However, when it reaches the first groove it is confronted by a larger volume and in accordance with a well-known gas law, if the volume increases then the pressure must decrease. Its new pressure (lower) is now P1. It continues its journey to the second groove. Its pressure now becomes P2, then P3, and so on. It is obvious that a groove will be reached when P12, say, = atmosphere. Therefore, no steam escapes, or at least it does not do it on this page. However, we get "nowt for nowt" and a price has to be paid. The price is an almost non-existent clearance between spindle and bore, and it must maintain this in a high temperature, possibly 500°-600°F. Yet the spindle must move up and down, up and down, 80-100 times a minute, 60 hours per week. For 50 years? Many of them did. In a labyrinth, the stroke must be short, have a perfect alignment and a non existent clearance.

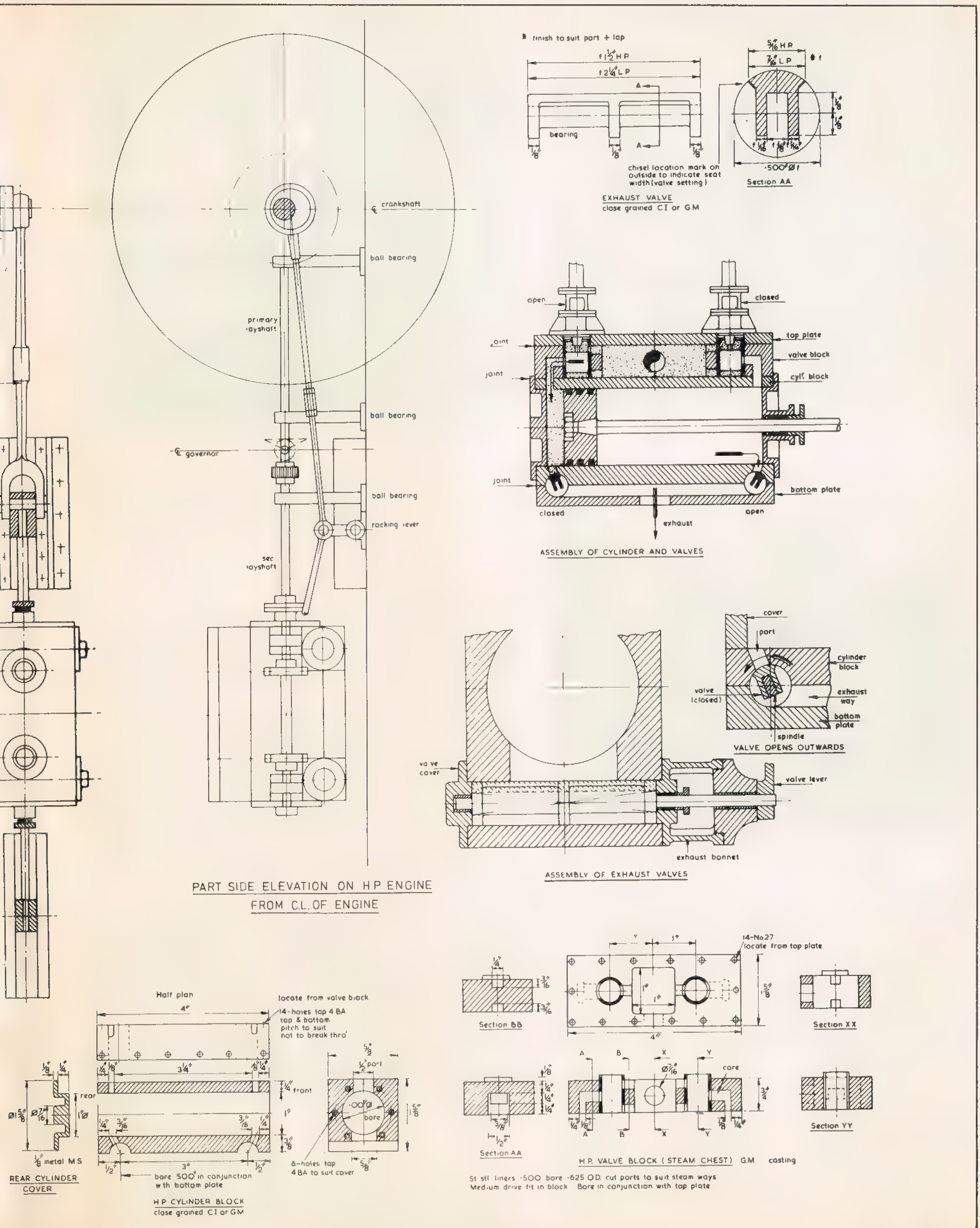
The main advantage of a well-made labyrinth, is its freedom from clinging packing, minimum effort is required to move the valve and it offers less resistance to governing action. It is advisable to check this before placing the dashpot in position. There must be no "play" but perfect freedom. The rate of the spring should be no stronger than is necessary to just close the valve. Otherwise governing will be affected.

The cylinders

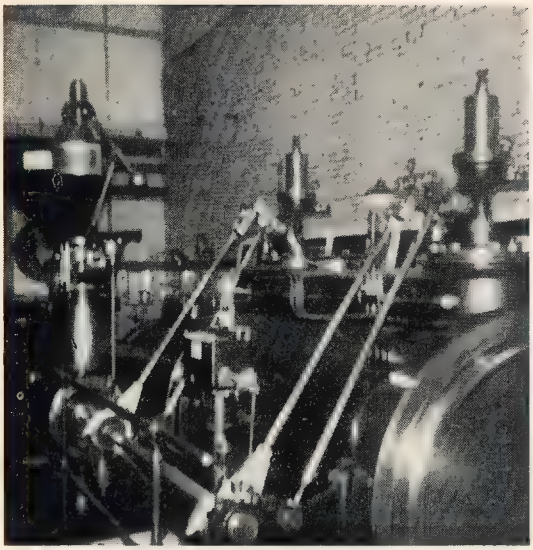
Each is composed of a top plate, valve block, cylinder block and bottom plate, the valve block and top plate forming the steam valve chest. The bottom plate partly forms the exhaust valve chest, and the steam valve chest is bored for the stainless steel valve liners which are an interference fit in the bores. Plate and block should be bored together. The steam ports are formed by coring the casting unless one is prepared to perform some complicated milling and drilling. The joint faces should preferably have a ground surface finish. The cylinder block is rectangular in section and bored to suit, and the ports may be cored or milled. After the bottom plate has been assembled, the bores are made transversely for the semi-rotary exhaust valves. The centre line of these bores lie on the joint line of plate and cylinder block, and the exhaust way in the bottom plate is either cored or milled. The bottom plate contains the exhaust from the two valves. These valves are not, of course, operated by trip gear, but by the reciprocating eccentric rod.

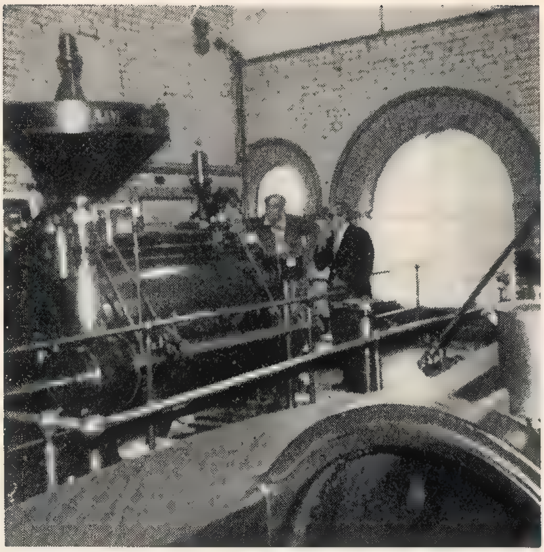
The steam lap on the valve should be at a minimum consistent with good closure, the valve steams on its bottom edge only and is delightfully quiet on a full size engine. The steam valve chest should be suitably drained but the exhaust chest is


END ELEVATION
PISTON DROP VALVE ENGINE WITH CORLISS TYPE EXHAUST
H P valve
H P secondary layshaft
H P primary layshaft
governor
engines
crankshaft
L P layshaft
L P valve
11"
14"
8"Ø
3½"
4"
H P ENGINE
bore ·00"
stroke 2½"
back dead centre
O/ALL DIMENSIONS ARE APPROX ONLY
L P ENGINE
bore 1·75"
stroke 2½"
mid-stroke
14-Nº 27 pitch to suit
locate from bonnet 8-holes tap 4BA
2-holes bore ·625" in conjunction with valve block
H.P. VALVE BLOCK TOP PLATE
G M
14-No. 27 pitch to suit
bore ·500" in conjunction with cylinder block
exhaust way
H P CYLINDER BLOCK BOTTOM PLATE
G M

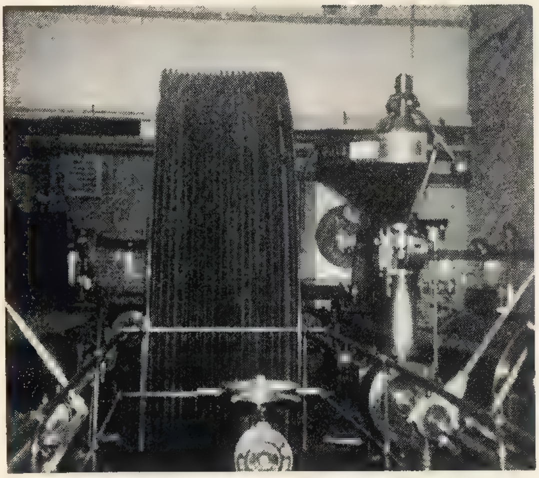


finish to suit port + lap
f 1½ H P
f 2¼ L P
bearing
chisel location mark on outside to indicate seat width (valve setting)
EXHAUST VALVE
close grained C I or G M
5/16 H P
7/16 L P
·500 Ø f
Section AA
crankshaft
ball bearing
primary layshaft
ball bearing
governor
ball bearing
rocking lever
sec layshaft
open
closed
top plate
valve block
cyl. block
joint
joint
joint
bottom plate
closed
open
exhaust
ASSEMBLY OF CYLINDER AND VALVES
cover
port
cylinder block
valve (closed)
exhaust way
bottom plate
spindle
VALVE OPENS OUTWARDS
valve cover
valve lever
exhaust bonnet
ASSEMBLY OF EXHAUST VALVES
PART SIDE ELEVATION ON H P ENGINE FROM C.L. OF ENGINE
Half plan
locate from valve block
14-holes tap 4 BA top & bottom pitch to suit not to break thro'
rear
front
bore ·500" in conjunction with bottom plate
6-holes tap 4 BA to suit cover
port
bore
1/8" metal M S
REAR CYLINDER COVER
H P CYLINDER BLOCK
close grained C I or G M
14-No.27 locate from top plate
Section BB
Section XX
core
Section AA
Section YY
H P. VALVE BLOCK (STEAM CHEST) G.M casting
St stl liners ·500 bore ·625 O.D. cut ports to suit steam ways
Medium drive fit in block Bore in conjunction with top plate





Photographs by courtesy of L. Twinney Esq.



These pictures were used to illustrate Alan Haworth's article of 6 January but are repeated here to give some idea of the type of model described.

largely self draining. The whole assembly is secured by No. 4 BA studs in the cylinder block and hex. nuts on the outside using the thinnest possible jointing material to secure steam tight joints. The layshaft which operates the eccentrics adjacent to the cylinder is supported on bearings carried from the side of the cylinder on brackets. I would suggest that these are ball bearings. Small ball races are readily available.

The exhaust valve levers are moved by a coupling rod via a rocker shaft from the exhaust eccentric. The piston which is mounted on a taper, is normal and requires no particular comments, nor do the cylinder covers. The valve coupling rods are to be capable of being lengthened or shortened. All circular joints are to be spigotted in components to maintain concentricity.

Exhaust valves

These are of the Corliss, or semi rotary type. They are basically circular wedge shaped plugs of cast iron, and are driven by spindles having a rectangular cross section for most of their length.

The outer or non drive end of these spindles are supported by the valve chamber covers, which form a bearing. The driving end which carries the valve levers is supported in a valve bonnet, bolted to the cylinder side. This bonnet also provides a stuffing box type gland for emergence of the spindle. The valve carries more exhaust lap than is usual, since this valve continues to move even after being closed. It should be a close running fit in its bore.

It has a rectangular slot along its length and rotates on three bearing collars. Another design provides a "tee" headed spindle with a mating slot at the end of the valve. This requires a shorter spindle. As has been said, it is a cylindrical CI plug and is milled to shape. It is necessary to leave the "seating" area oversize in width and file down to correct dimension to suit exhaust port and valve travel. The single eccentric determines both events on each valve.

To be continued

PISTON DROP VALVE MILL ENGINE

Sheet 1 of M34-G.A., cylinder details; valve blocks and assembly, is available from the Sales Dept., Model & Allied Publications. Price Code E.

VERTICAL SLIDE AND VICE

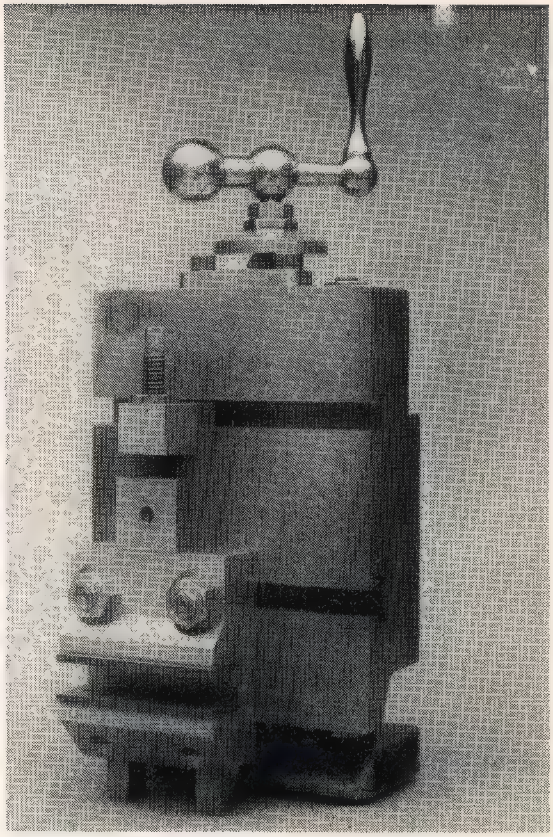
by A. Shackell

TWO RATHER SPECIAL features of this slide and vice are the exceptional rigidity, and the fact that all the machining for making them can be done on the lathe for which they are intended. The rigidity is partly due I think to the generally massive construction, also to the way the holding down bolts pass right through from the top of the structure, and the vice, though movable, is part of the slide.

Construction is evident from the drawings and photograph. Two simple wood patterns without cores are needed for the two main iron castings, most other parts are made from mild steel bar. The reason the slide drawing is not dimensioned is that a critical dimension affecting several others depends on the cross slide boring table of the particular lathe, the centre distance of the two guide pillars and thus of the holding down bolts being made to match the tee slots of the table. In my case (lathe 4 in. centres) this was 2½ in., so if yours is different you would have to make the appropriate changes. But the drawing can be scaled for parts not affected.

Most of the work is fairly straightforward, though I would like to deal with the procedure for boring the two main holes in the sliding member and in the base part, as it is most important for these to be parallel and in true alignment. I would not recommend attempting to bore these parts separately.

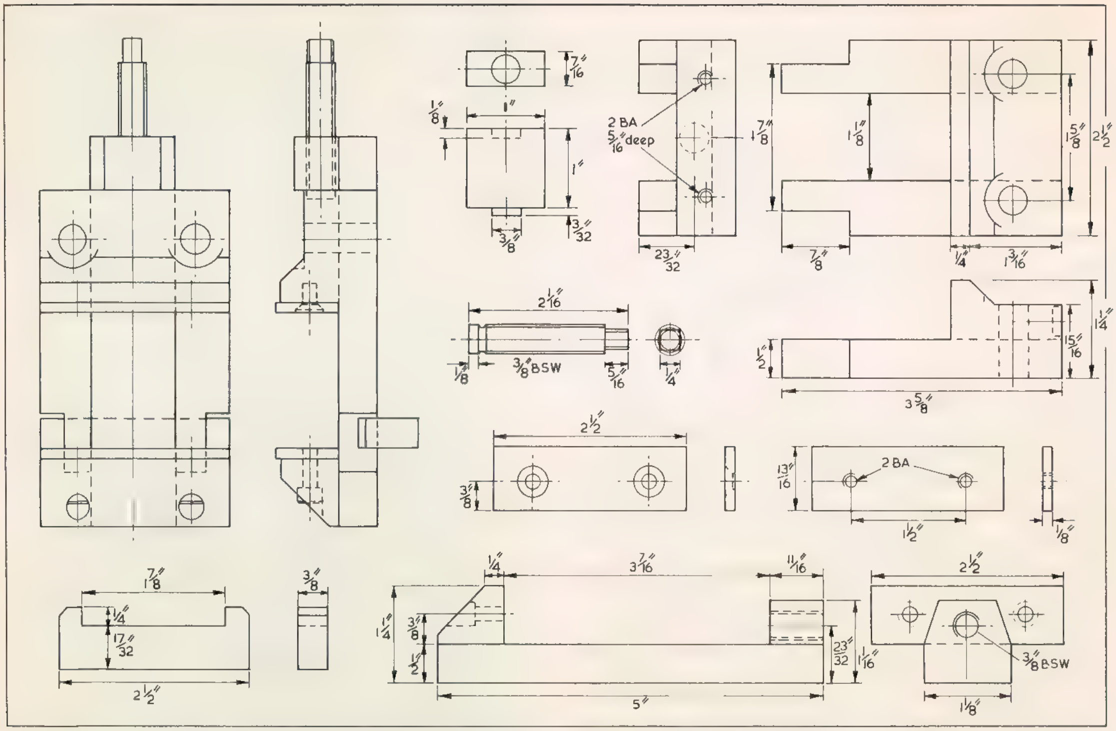
We start with the feed screw, ½ in. dia. 10 t.p.i., square thread, right hand. When this has been made the base part can be chucked, its bottom faced and the middle hole drilled and bored, ⅜ in. dia. for the threaded portion, 9/16 in. dia. for the clearance. Out of the chuck the two other holes can be marked out and drilled, leaving them about ⅛ in. undersize. These holes could possibly be used for the bolts to hold the reversed part on the faceplate for internally threading to suit the feed screw. Otherwise use clamps, but anyway see that the hole runs really true before screwing. At this stage the end of the stem can be faced to length, then by passing a ⅜ in. rod screwed both ends right through the part and the hollow mandrel of the lathe, nutting up reason-



ably tight will allow the clamps to be removed and the outside of the stem and top surface of the base to be machined.

Now for the main sliding member. I assume that when making the pattern the reader has checked that his lathe will swing it for facing. This part is rather awkward for holding in the four-jaw chuck, and I suggest a couple of 5/16 in. tapped holes not more than ⅜ in. deep on the centre line into the solid part of the casting would be satisfactory for holding it on the faceplate, after dressing it with a file to ensure stable contact. I did mine 16 years ago, and cannot now recall how I managed about this, but there are no tapped holes. Next I think it would be a good idea to machine the four edges true and square by milling with the part clamped on packing on the boring table. Later the face at least could be scraped for flat if desired.

We now come to the special procedure for boring the guide pillar holes. It will be necessary to make or see that you have a suitable boring bar. The job is set up on the boring table on packing to bring the height correct, and fixed truly square. The first operation is to drill the two holes using progressively larger drills to about 1/16 in. below finished size. During this operation you will note the two readings on the cross slide collar for later position-



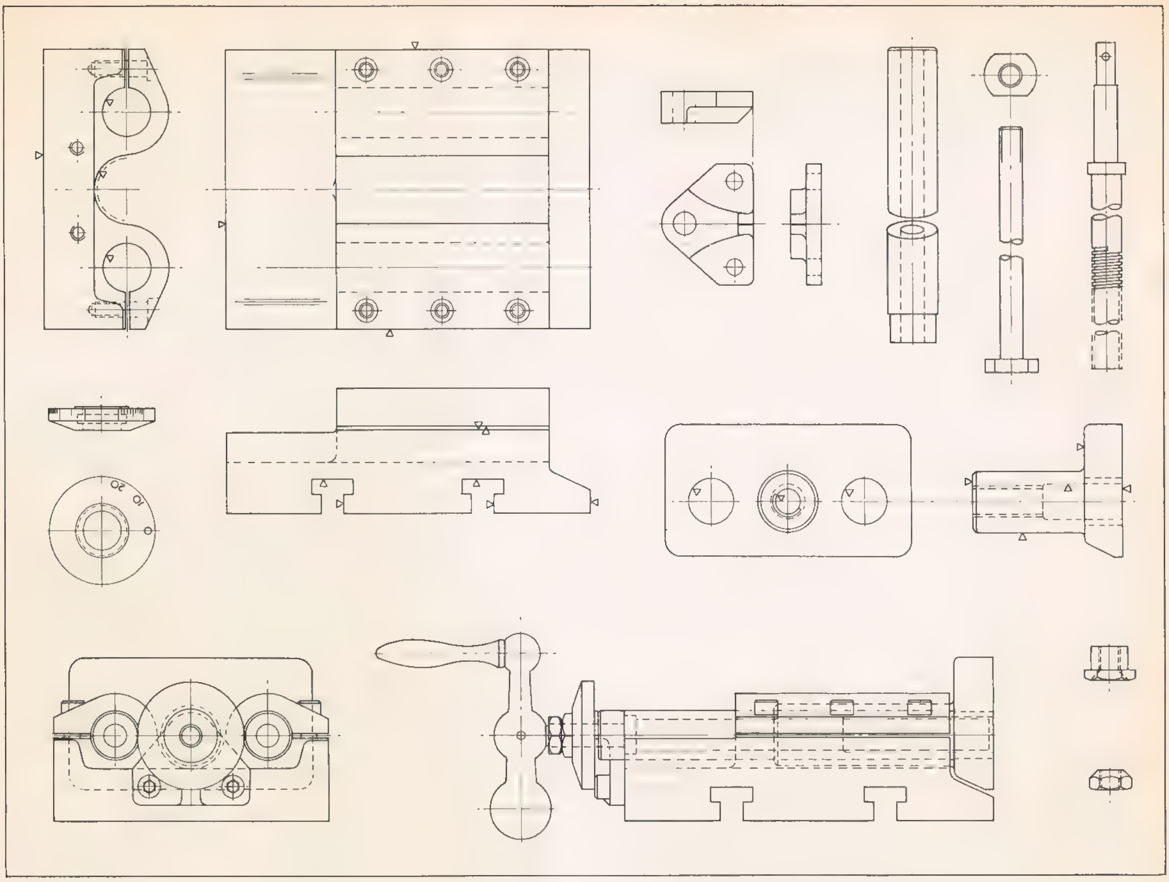
ing. The difference of course should agree with the centre to centre dimension of the slots in your boring table. Now the cross slide is set half way between these two positions and the hollow trough down the middle of the job bored to fit the turned stem of the base part. This part is then clamped in position without disturbing the clamps already there. One way of doing this is to have the first two clamps at diagonal corners and the final clamp right across the middle between them.

The holes can then be finished bored, making those in the base part say 1/16 in. less in diameter than the long ones. Success of the whole affair depends on getting this right so take your time. I would advise that the final cut on each pair of in-line holes be taken with the cross slide locked in the one or other position; that is, with only one change of position for the two pairs of holes.

With regard to the pillars, unless you can get precision ground rod of the required size, these must be turned, to make sure they are round and straight. In any case a fixed steady is needed for turning the lower ends and drilling the long holes. By careful drilling from both ends it should be possible to get holes straight enough to take the bolts with no more clearance than the drill itself makes. If you don't have a steady and whether you use p.g. rod or not I think it would be wise to avoid the possibility of a slight error in concentricity by not turning the ends to leave a shoulder. Of course this means that the holes in the base would have to be bored about one thou. less than the long holes to get a press fit, and this is probably not so easy to do as turning the pillars to suit the holes. Perhaps I should have described my steady first. Pressing or drawing the pillars into the base should be done with the pillars held in the sliding member.

If the bearing bracket for the feed screw is made from a piece of cast iron, there is no need to bush it. The graduated collar can well be made of gunmetal. After dividing it with 100 lines, using the shaper mode of the lathe, I had the numbers engraved commercially. Every tenth line goes right across the width of the edge of collar, with the corresponding number on the conical surface. The lines for fives are about three quarters of the width and the others about half-way across. I made a little jig to bring the appropriate part of the conical surface level for the engraver so there was no trouble here. The friction device is simply a piece of phosphor bronze or nickel silver about 17/32 in. long, ⅛ in. wide and twenty thou. thick slipped into the internal groove in the collar so that it bears tangentially on the spindle with appropriate pressure. It works perfectly.

The tee slots will of course be milled last, when the slide is operational. If necessary the feed screw and its bracket can be detached and the sliding member inverted for doing the upper slot. My slots are a repeat of those in the boring table so that the same accessories can be mounted, but if I were making again I might have three slots at the pitch of



the vice bolts, so that the vice could be used with jaws vertical if required.

As the drawing shows, the vice is essentially just two parts plus the screw and the fixing bolts. The third part, forming the base in effect, is the moving part of the vertical slide itself. This arrangement reduces the overhang, improving the rigidity, and simplifies the work of making.

The two parts are both made from 2½ in. by 1¼ in. bright mild steel, and there is a good deal of cutting away to do. I found the bandsaw useful, but a lot can be done by drilling rows of, say, ¼ in. dia. holes and chipping away between them. Milling to size can be done using the vertical slide; final fitting of the mating surfaces is best done at the bench. The part shown at lower left of drawing was intended to go in the second slot to prevent the legs of the fixed part from spreading, but I have never found it necessary.

As can be seen, opening and closing is done in two stages, with a removable distance piece to avoid a long screw. This screw by the way should be made from silver steel, hardened and tempered deep blue. Some of the thread is left on the corners of the square.

There is a problem with the jaw plates of correcting the distortion from hardening. If I recollect properly, what I did was to work them as flat as possible on a revolving wood disc faced with emery paper, finishing by lapping on a cast iron plate with valve grinding paste, thinning the paste on the plate with a little paraffin. The 2 BA fixing screws should preferably be socket head type.

I frequently use the slide and vice on the lathe in preference to the vertical mill I have since acquired, partly, I think, because of the better visibility, but also sometimes because it is more convenient to have the cutter spindle horizontal and the vice vertical and parallel to it. I might say that when it is required to fix the slide at some angle not square with the lathe, one fixing bolt only has been found quite adequate.

Something I should have mentioned before is that after finish boring the holes for guide pillars in the set up as described, I removed the base part leaving the other member still clamped in position and re-bored the trough to give about 1/32 in. radial clearance, so that only the pillars make contact in use. Another point, and this concerns the pattern making, is that to provide for convenient clamping for the boring operation, the width of the casting for the sliding member after machining the edges should be at least ⅜ in. less than twice the pitch of your boring table tee slots.

JEYNES' CORNER

Drilling Cross Holes

AT VARIOUS TIMES over the years I have noticed the troubles some readers have experienced in the cross drilling of round stock, indeed several letters during the past year, and a letter to Postbag, and an article on the subject appeared in the same issue of *Model Engineer* for 4 November 1977, the latter being the rather elaborate jig made by Mr. Shackell.

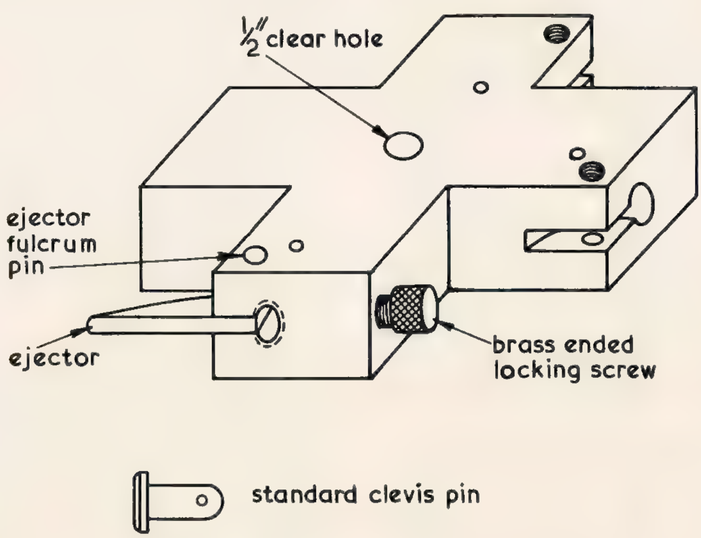
Many years ago, among the components for switchgear manufactured for our own use by the firm I was employed by, were large numbers of clevis pins, and noticing Mr. Cheeseman's method of producing clevises, possibly the method used in my old shop for drilling the holes for the split pins 1/16 in., 3/32 in. and ⅛ in. may be of interest to some readers who try to drill a hole squarely through small round stock just resting in a Vee block without being secured in any way from turning, when it is odds on that the hole will not be just as they wanted.

The jig was a sawn out cross intended for part of a universal joint, which somehow had found its way to the scrap bin, and was retrieved from there; the material being UBAS steel. It was faced up each side, and a ½ in. hole put through the centre for bolting to drilling machine table. Holes were drilled and reamed in three of the arms, sliding fits for the three sizes of clevis pins ¼ in., 5/16 in., and ⅜ inch. Holes were drilled and tapped at right angles to these for clamping screws, then holes for the drills 1/16 in., 3/32 in., and ⅛ in., were accurately marked off at the requisite distance from the faced end of the arm against which the clevis pin head was pushed and clamped by set screw. A pad of brass between its end and pin body saved marking or bruising. The holes, after they had passed through the hole receiving the pin body, were enlarged to help swarf get away.

When the jig was first tried out, it was found that the pins, after drilling, stuck in the holes, so a slot was milled, and a fulcrum point drilled for an ejector, made from a piece of gauge plate steel, and a very slight pressure ejected the pin.

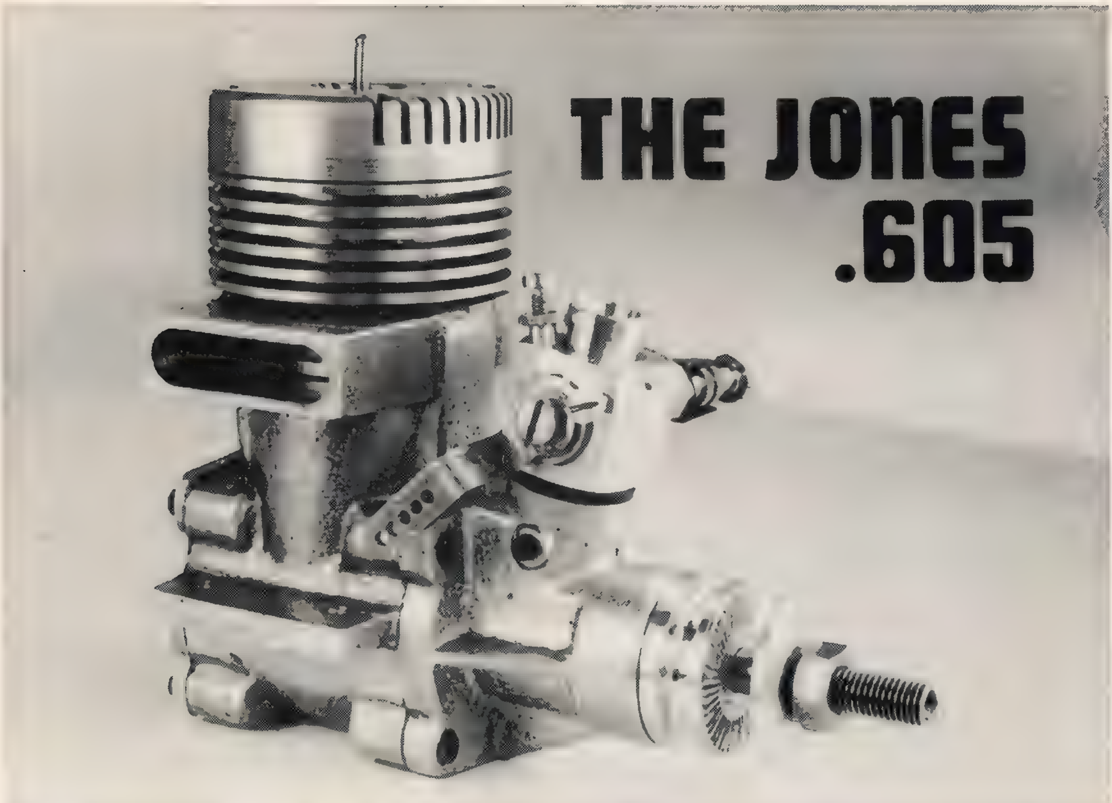
Only three of the arms were used, and the whole lot was casehardened and lapped, and was still being used when I left. Before it was hardened, another hole was drilled through it, to enable a wire to be put through to hang it on the drilling machine ready for use. I had expected a lot of trouble from the swarf, but what did not come up the drill flutes, passed out through the clearance holes below.

It had been intended to fit replaceable bushes for the drills, but it answered so well that this was never done, at least in my time there. The jig described in the article for 3 February by Mr. Abigail will produce accurate results, but only if it is carefully used; careless setting will still produce the most unwanted results, so often achieved, and possibly broken drills too.



CROSS DRILLING JIG FOR THREE SIZES OF CLEVIS PINS

THE JONES .605



Colin Jones describes his 10 cc. glow plug motor. Castings for this engine are commercially available

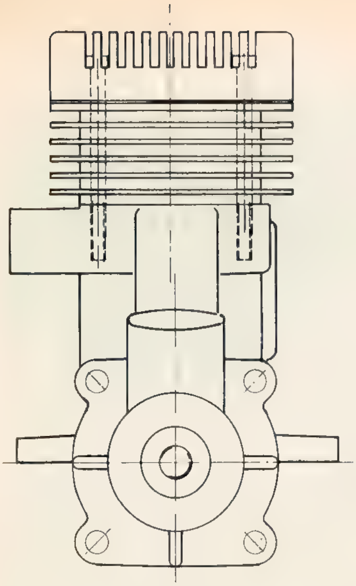
AS A RADIO MODELLER and a very amateur model engineer with about six months' experience with a lathe, I thought it would be a good exercise to build an engine for one of my models. The two stroke engine was the obvious choice because of its relative simplicity, its high power output, and its lightness. The only drawback was the non-availability of castings, but thanks to a colleague of mine, whose help has been invaluable to me, patterns were made for the engine. These patterns were made as small as possible, consistent with strength and ease of machining.

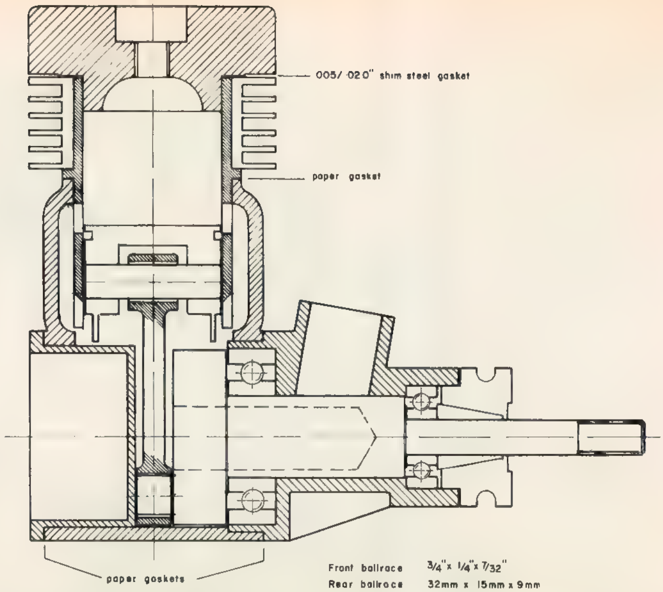
Some of the measurements on the drawings are metric, but these are inescapable as only metric bearings are available in the size required. Most of the dimensions are odd decimals and are consistent with lightness and keeping the overall size down. The finished engine weight is 16 oz. which is compatible with the mass-produced engines on the market today. The b.h.p. produced was about 1.2 and was produced with an 11 in. x 7½ in. wooden propeller at 12,250 r.p.m. using standard fuel and a silencer. These figures can, no doubt, be greatly improved upon. The more experienced constructor will realise that by altering port timing, the crankcase volume, compression ratio, etc., the performance of the engine may be improved. With a good set of castings it should be possible to increase the capacity to about 12.5 cc. by increasing marginally the bore and stroke. The figures given are for an engine of 10.6 cc. capacity. This uses a 1 in. bore for which standard piston rings are available but, of course, does not comply with competition class rules.

The set of castings and bits are available from Woking Precision Models Co. Ltd.

The crankshaft

This should be made of a high tensile steel to withstand the high loading and wear to which it is imposed. First the bar is held in the three-jaw chuck and the outside turned 20-25 thou oversize, whilst supported by the tailstock centre. The gas passage is then drilled to depth and size, (don't forget the big-end length). The bar is now removed from the chuck in order to centre drill the front of the bar. If your three-jaw chuck is accurate it can be done in this, otherwise use a four-jaw chuck and



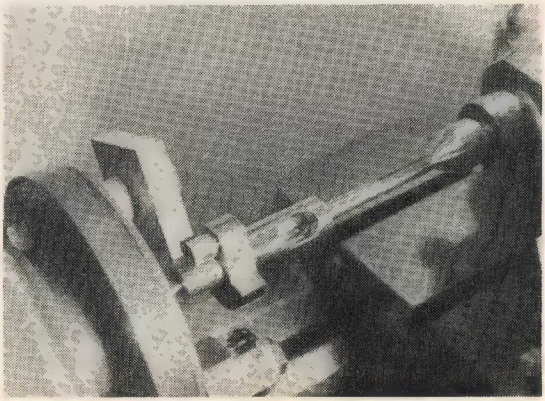


test dial to get the bar true, or turn a mandrel in the three-jaw chuck to hold the bar by the gas passage. A dummy centre is now made to fit the gas passage and the bar mounted between centres, and the general shape is roughed out, leaving 30 thou or so on all dimensions. The crankshaft is placed in the four-jaw chuck with the web sticking outwards. The shaft is offset to machine the big-end pin which can be done very accurately using a test dial which, when the offset is correct, will show a difference equal to the throw (.828 in.). If a test dial is not available one will have to rely upon traditional marking out procedures. The big-end is now turned and finished to size and the face of the web finished. A small internal radius should be left in the corner of all journals, as sharp corners are a focus for the formation of cracks. The lightening hole is also bored through the crank pin. At this point I had better mention finishes. It is very difficult to get a good finish on high tensile steel by ordinary turning methods, a tool post grinder is a useful item, but not likely to be possessed by a beginner. I leave all bearing surfaces about 1½-2 thou oversize and a little longer than necessary, about 20 thou, and then, using carborundum tape, (½ in. wide) reduce the pin to size, finishing with a fine grade to give a good shiny finish. While using carborundum on the lathe, cover the bed under the job with paper and take care that the surface does not become tapered. The crankshaft is now put between centres again and is driven by the big-end pin so protect this well, preferably with a brass sleeve. The mainshaft and web are now turned to size and finished. The main bearing should be a tight push fit on the shaft, not a force fit. The thread is cut on the front of the shaft, ¼ in. x 28 t.p.i. being chosen as most commercially available fittings have this thread. This finishes work on the crankshaft for the time being. The valve opening and counter balancing is best carried out later.

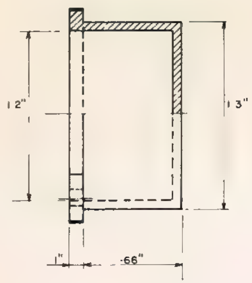
The liner

This is made from centrifugally-cast C.I. The bar is held in the three-jaw chuck with about 2¼ in.-2½ in. protruding. It is bored out leaving it about 20 thou undersize. The portion held in the chuck should not be bored out larger than ⅝ in.-¾ in. as this could lead to distortion due to pressure from the chuck jaws. The outside is then turned to about 20 thou oversize, the flange being formed at the same time. The ports are marked out leaving the liner in the chuck, and using the micrometer on the top slide to mark out with a sharp edged tool using the bottom of the liner as the reference point. The liner is easily divided into four giving 90° spacings between sets of ports by using the lathe gear train; for example if the lathe spindle is fitted with a 24-tooth gear it is quite easy to use a blade of metal to wedge the gear every sixth tooth — this will give the four equal divisions — or simply use a dividing attachment. The ports are drilled and filed to their final shape, the transfer ports are angled upwards and towards the rear of the cylinder, whilst the boost port is angled as steeply as possible upwards.

Crankshaft set up on dummy centre.

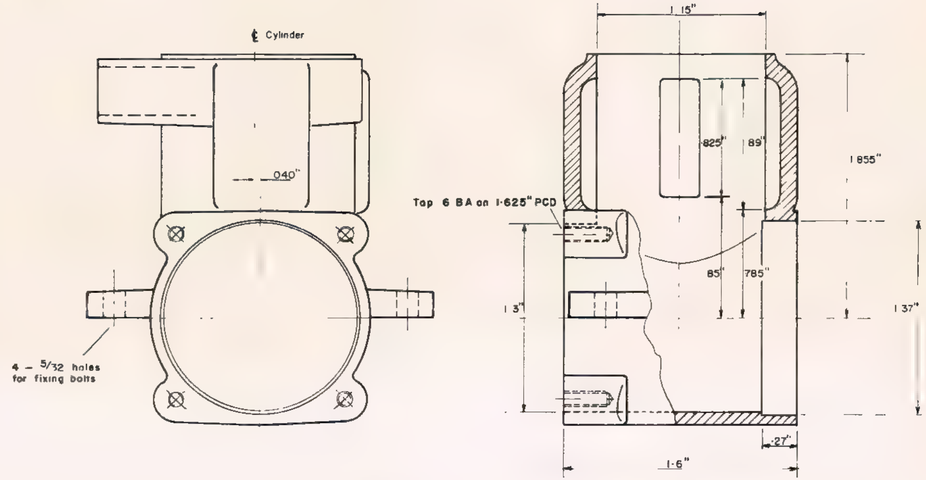


NOTE External contours of main castings are as cast from designers own patterns



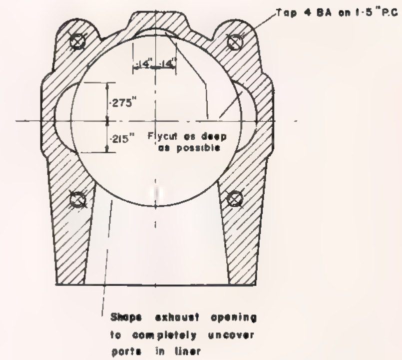
END COVER

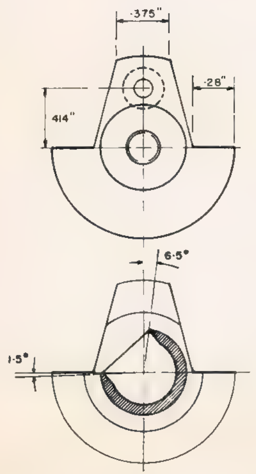
Al. casting.

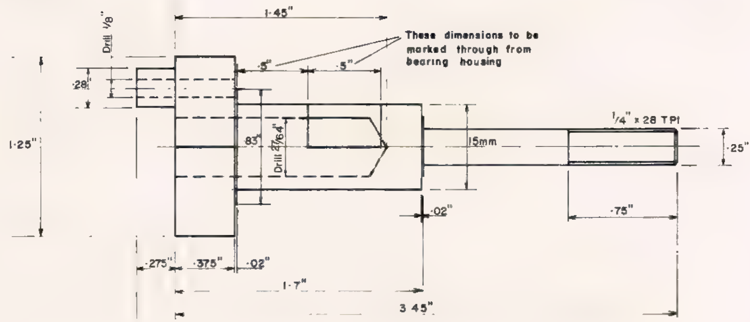


CRANKCASE

Al. casting







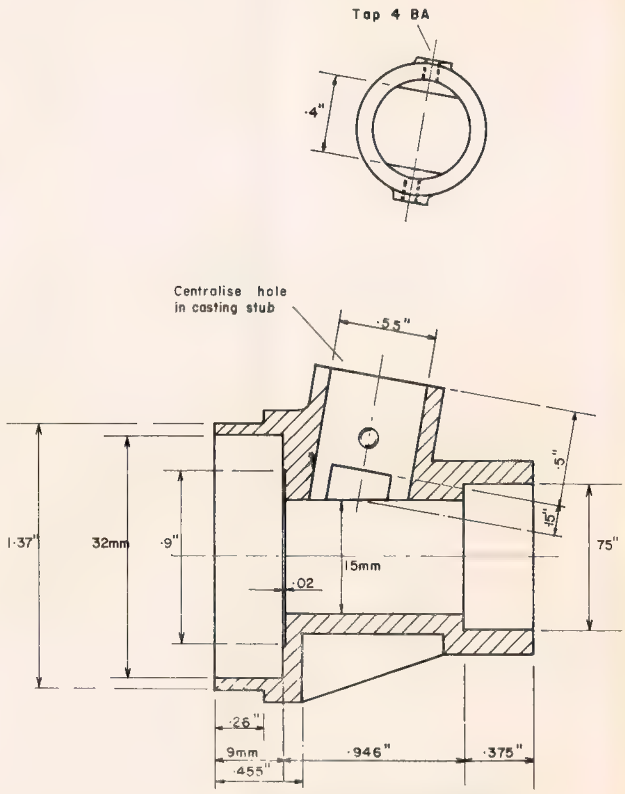
CRANKSHAFT – H.T. Steel

It is quite important to get the upper portions of the ports correct, as this will affect opening times and thus performance. When the ports are complete the liner can be finished to its final size. It is a good idea before turning the outside to size, to use a narrow parting tool, about 50 thou wide, to make a cut either side of the flange to a depth of 20 thou, this gives the turning tool a clearance to run into at the end of the cut thus avoiding damage to the flange. The bottom of the bore is chamfered and the liner parted off. The top of the bore is chamfered by holding very lightly in the three-jaw chuck which greatly facilitates the fitting of the piston with the ring in position. Finally, machining marks are removed by lapping.

Front housing

The front housing is held in the three-jaw chuck by the elongated front stub. The casting is then made to run as true as possible using the circular portion on the rear of the casting, the chuck is checked for tightness and the casting checked for alignment. Throughout machining fairly light cuts are made so that the alignment is not disturbed. First the 15 mm. hole is drilled and either reamed or bored to size with a boring bar, the crankshaft should be a good snug fit, but free to revolve. The housing for the bearing is then bored and the flange turned, the bearing should be a good tight fit — the housing is made about ½-1 thou undersize and then heated to fit the bearing, "Sizzling" heat should be sufficient. It is a good idea to make a gauge on the "Go — No Go" principle and if there is any doubt about fitting bearings it is a good idea to practise on a piece of scrap beforehand. Don't forget to relieve the face of the bearing housing to prevent the inner track of the bearing rubbing.

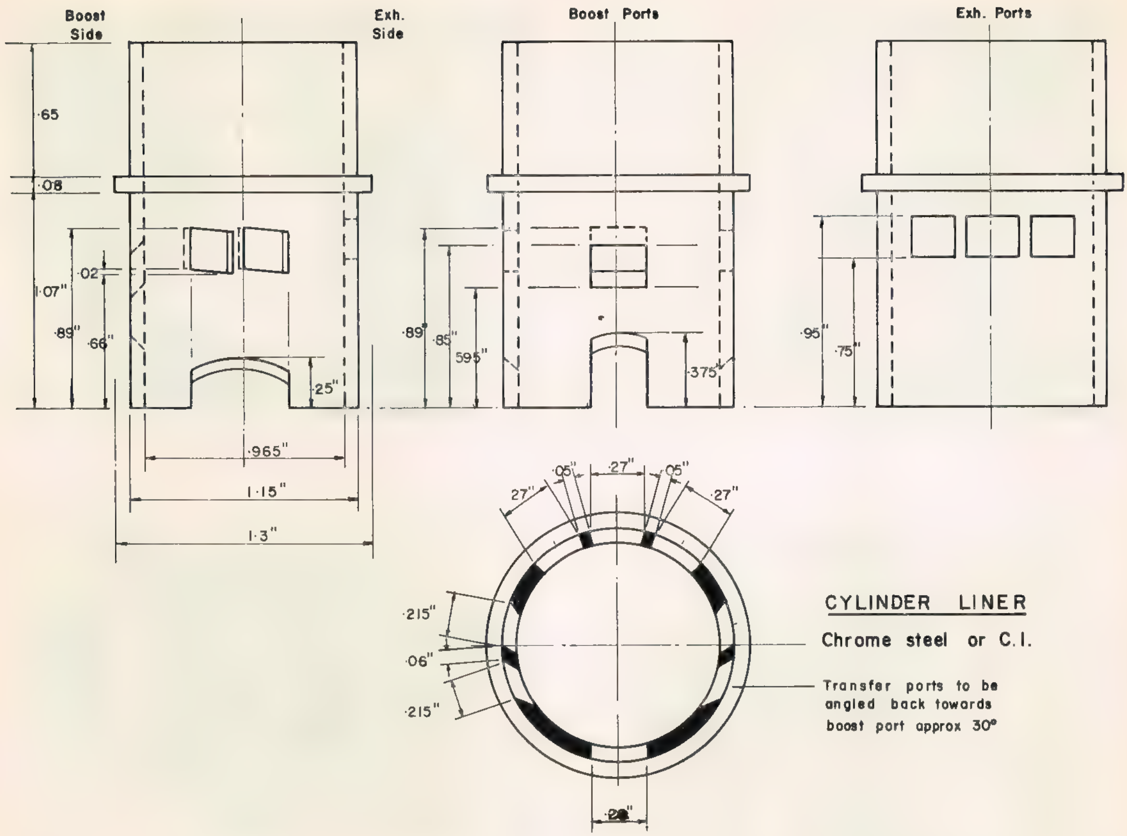
When all operations are complete the casting is removed from the chuck. A spigot is turned from some scrap steel to 15 mm. + ½ thou and 0.9 in. long, the casting is then warmed and pushed onto the spigot with the end already turned facing the chuck. The front bearing housing and spigot are turned to size as follows: the casting is first turned to length using vernier callipers for measuring (sufficient room should be left between the rear of the casting and chuck to insert the callipers). The bearing housing is bored using the top slide, the micrometer of which is used to gauge the depth. Owners of Myford lathes can use the micrometer wheel on the lead screw for gauging the depth. Each cut should be about 5 thou short of its depth until the final cut which goes to the full depth, the cross slide is then moved across removing the final 5 thou, this imparts a good finish to the bottom of the hole. The casting is then warmed and removed from the spigot. It must be noted at this stage that the top slide must be capable of turning a parallel-sided hole. This can be done before any boring commences by mounting a piece of scrap in the chuck and adjusting until it turns parallel.



MAIN BEARING HOUSING

Al.casting

The carburettor mounting stub is the next item for machining, which is done by clamping it in the vertical slide, or angle plate mounted on the cross slide. The angle of the carburettor stub is 10°, so the casting is offset by 10°, and aligned so that the hole drilled in it will be truly central. The hole for the carburettor mounting stub is 17/32 in. x ½ in. deep. If a commercial carburettor is to be used, the sizes can be adjusted to suit. Now with a 13/32 in. end mill continue the hole through into the crankshaft journal, then elongate the hole to the extremities of the hole for the carburettor stub, thus forming an elongated passage 13/32 in. x 17/32 in. While the front housing is clamped to the top slide it can be re-located for drilling and tapping the holes for the 4 BA carburettor retaining screws. The front housing is now complete except for the holes for the four 6 BA caphead retaining screws, these can either be located by measurement, or a jig. I use a jig as this ensures that the holes all align with one another. A simple jig is made from a flat piece of ⅛ in. or 3/16 in. steel about 1¾ in. square. The position of the holes are accurately marked out, and the centre



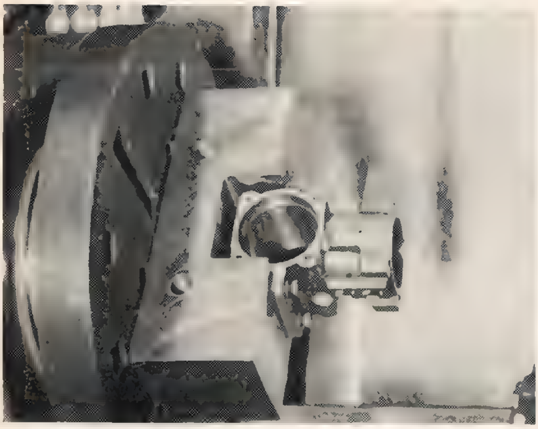
marked where the diagonals cross. The holes are now bored and the centre drilled to, say, 3/16 in., bobbins about ¼ in. thick are now turned, these should just fit into the turned portions of castings. A 3/16 in. hole is drilled in the centre of the bobbins and then bolted to the drilling jig. This will now accurately align the holes in the front housing, main casting and backplate. The same principle can be applied to the cylinder head, fins and maincasting for the head retaining bolts. When the holes have been drilled in the front housing they are spot faced with a 3/16 in. end mill to provide a true surface for the bolt heads.

Main casting

The mounting lugs are first cleaned up and the mounting holes drilled, the positions of which are not specified as constructors will no doubt want them drilled to fit an existing engine mount. The bottom of the lugs must be flat and parallel to each other. The casting is mounted on angle plates and bolted to the face plate, ensuring that the angle plates are a true 90°. For those who think the trouble worthwhile a jig can be made out of a block of steel about 1½ in. square and 3 in.-4 in. long. A slot is made across it to accommodate the lower part of the crankcase below the mounting lugs. I must again emphasise that the two faces which will be mounted on the face plate must be at right angles to each other. The casting is then aligned using the periphery of the crankcase, the centre must also coincide with the bottom of the mounting lugs as further measurements use this line as a reference.

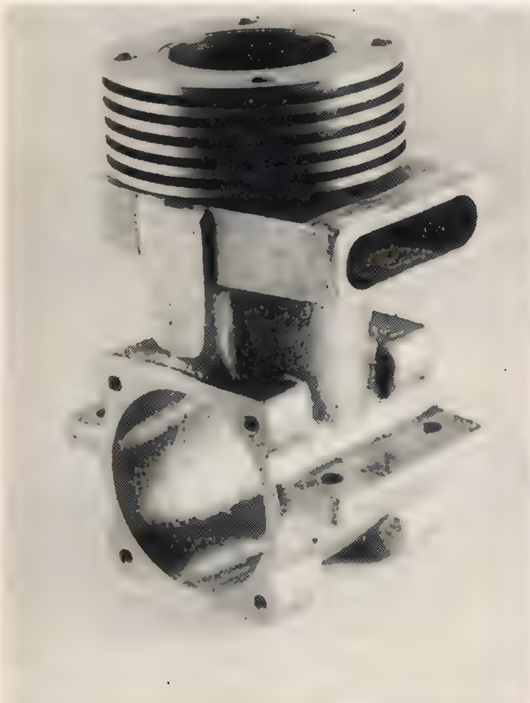
The crankcase is bored out to 1.3 in. and the front end faced off. It should be 0.8 in. from the centre line of the engine to this front edge. Next, the register is turned into which the front housing fits and this should be just a good fit. The casting is reversed on the angle plates, re-aligned and the rear edge machined, the overall length being 1.6 in. It may be necessary to take a few thou off the projections which carry the transfer ports.

The casting is now removed from the angle plates and mounted upright on the face plate for boring the cylinder stack. The casting is again aligned, bearing in mind that the cylinder is offset towards the exhaust side of the casting by .040 in. It is now bored out and the casting machined down to its correct height, the hole extending right through into the crankcase. The liner must be a good tight fit into this hole, preferably being inserted by heating the main casting as with the bearings.

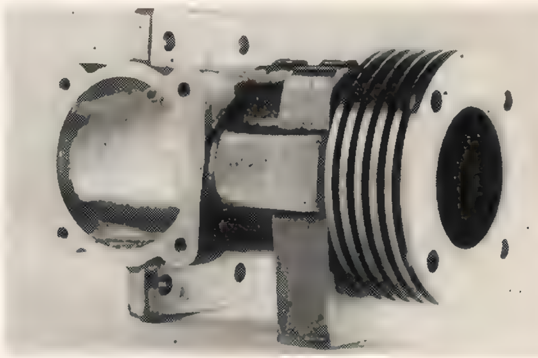


Main casting set up for boring the cylinder.

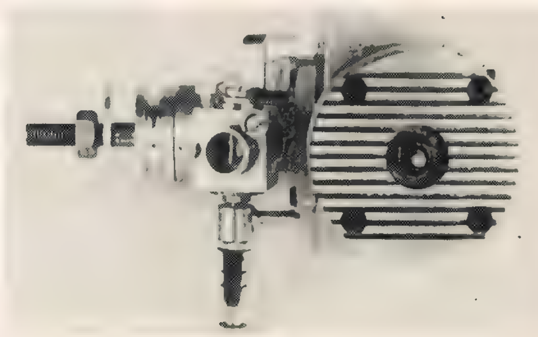
The first stage of machining main casting.



The completed main casting and cylinder jacket.



The liner fitted.



This view is for the birds!

Now we come to the gas passages, which are best marked out from the liner thus getting a good alignment of ports to passages. The casting is mounted on either the vertical slide or on the cross slide with appropriate packing to bring it up to the height of the cutter, which can be a length of ¼ in. silver steel, with at the one end an ⅛ in. hole drilled through. Another hole is drilled from the end to enter the first hole and tapped 6 BA. An old ⅛ in. drill is used for the cutter, which is about ⅜ in. long, this is inserted in the end of the bar and held in position with a 6 BA screw. A ⅛ in. should be protruding, this is the depth of the passages, the bar is now held in the chuck and used as a fly cutter to form the passages. It will be necessary to take several cuts to form the passages, making sure you do not go too deep and break out of the side of the casting. The exhaust port is simply formed by mounting the casting upright on the vertical or top slide and milling it out.

To be continued

SWINDON DRAUGHTING

by Bert Perryman

IN THE *M.E.* for 18-30 November 1977, an Australian reader, Mr. C. Bamford asks for an article on this subject. I immediately contacted the originator of this arrangement, Lionel Woodhead, and he has very kindly furnished the basic dimensions so that anyone can work out for himself, the necessary sizes for his own locomotive.

I should state here and now that this is not *exactly* as laid down by Sam Ell, who carried out experiments at Swindon Works, subsequently improving the steaming of the BR Class 2 by no less than 120 per cent. Lionel is a GWR fan having served an apprenticeship at Swindon for a short time before he was removed by his father and transferred into the world of banking! However, he has built a 2½ in. gauge, four-cylinder "King", a 2½ in. gauge "County", and "1500", a 3½ in. gauge four-cylinder "Castle", a real gem this, and lastly, a 5 in. gauge 47XX, a 5 in. gauge 58XX and finally a 5 in. gauge "Bulldog". The larger locos all had his draughting modifications and also a true "Swindon" valve gear exactly scaled off the full size drawings. All his locos have been built from the official drawings and as any one who has handled them will agree they all perform in the approved Swindon manner.

I was the first person to be converted to his draughting formula, although I am not a Swindon man, instead hailing from Brighton and being used to the complaints about the Marsh 4-4-2 tanks. With the exception of the wonderful I3 class, the 1's, 2's and 4's must surely rank as some of the worst steamers ever seen in Britain. My own Maid of Kent built to LBSC's specification used to go well for about two hours after which there was a noticeable falling off in the steaming, due to choked fire tubes. Lionel suggested fitting it with his system of draughting. I was a bit undecided at first but after he offered to make all the necessary bits for me all I had to do was fit them, I decided to co-operate.

The result exceeded even Lionel's expectations and his great moment came at an exhibition and track day that the Brighton Society had staged in Hove Park, during the mid sixties.

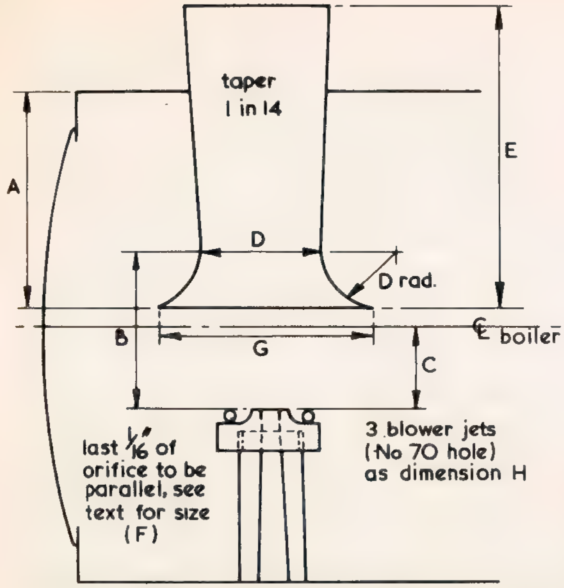
My "Maid" was not even down to run, being on Exhibition. Passenger hauling started about 10.30 a.m. and was brisk. Then the Gremlins appeared and two engine failures in a few minutes stopped the service and a queue began to form for rides. The only thing available was the "Maid" and I whisked it off the show stand and lit up in a hurry. The efficiency of the modified blower was now realised, the loco was in service five minutes after lighting up. It stayed on without respite until 6.00 p.m. doing the hardest seven hours continuous duty it ever did in its life. It was still steaming well at the end of the day, at times it was called upon to take four trailer cars, as the Gremlins continued to plague the other locos, but the "Maid" just revelled in it. When the smoke box door was opened when she did at last get back "on shed", the ash had all been pulled through the smokebox and piled up against the door, leaving the tubes comparatively clear. This fully vindicated Lionel's draughting in my eyes.

He has modified Sam Ell's original formula slightly to render it more suitable for model work. It is imperative that the blast pipe nozzle should end in a *parallel* form, and not be countersunk from the top, otherwise the exhaust stream will fan out. A most noticeable feature of all the locos fitted with this system that I have handled is the remarkable efficiency of the blower as already mentioned. Once steam appears on the gauge, say 10 p.s.i., the suction fan is removed, and if turned well on, the blower will cause the gauge needle to emulate the "seconds" hand on a watch. My 5 in. gauge "Gladstone" fitted with this system is a very free steaming loco, and the exhaust is very silent (as was the prototype); the steam seems to hardly have enough velocity to lift it out of the chimney.

All exhaust ways must be as large as possible in any case, larger than the blast nozzle itself.

The dimensions of the blast nozzle given at "F" enables one to try one or two within the limits given to obtain the best results.

The dimension "E" has been taken from the 2 ft. 4 in. length of a particular class of Swindon Chimney Liner. These lengths vary from class to class and once "D" has been established the 1 in 14 taper starts there and finishes at the point where it touches the bore of the chimney casting. Each model loco will, therefore, require its own length to be calculated. The firebars also have an effect on draughting. Our experience has shown ⅛ in. thick bars with 3/16 in. air spaces between to give the best results. This of course, for 5 in gauge. I have found stainless steel firebars give much better ser-



vice than cast iron grates. The latter tend to warp badly and even melt.

Dimension	5" gauge	3½" gauge	2½" gauge
A	1⅛" to 1 21/64"	⅞" to 15/16"	9/16" Full
C	17/32" to ⅝"	⅜" to 7/16"	9/32"
E	2½"	1¾"	1 3/16"
B	Not critical	1⅓ to 1½ times choke diameter	
D	AREA of	.048 x grate area in sq. inches	
F		$\frac{\text{Choke diameter}}{2.8 \text{ to } 3.2}$	
G		Choke dia. × 2	
H	Pitch Circle dia.	is 3/32" less than D	

Note: Dimension "D" .048 x grate area will give the *Area* of "D". Look up table of Area of Circles to find the *Diameter* of D.
Dimension "C" is not critical in ANY gauge.
Dimension "B" is not critical in ANY gauge
Dimension "E" is not critical in ANY gauge.
The Taper of 1 in 14 is *VITAL*.

CLUB DIARY

Dates should be sent at least five weeks before the event to ensure publication. Please state venue and time. While every care is taken, we cannot accept responsibility for errors.

MAY

6 **Witney and West Oxfordshire S.M.E.** Open day at Blenheim.
7 **Rugby M.E.S.** Members running day.
7-24 **Sept Every Sunday.** Bressingham Live Steam Museum & Gardens, west of Diss on A.1066 to Thetford Road. 1.30 to 6 p.m.
7 **Kinver & West Midlands S.M.E. Ltd.** Steam Gala. 10 a.m.
8 **Erewash Valley M.E.S.** General meeting at 24 Park Drive, Landiacre, Notts.
13 **Midland Counties Miniature Steam Engine Club.** Stretton Church Hall, to raise money for the felling of their trees — all day.
13 & 14 **Tyneside S.M.E.E.** Open weekend. Track (exhibition park) visitors will be welcome.
15 **Leicester Society of M.E. Ltd.,** model night. The Royce Institute, Crane Street, Leicester. 7.30 p.m.
16 **Milton Keynes Model Society.** Flying evening at the flying field, Wolverton Mill, Milton Keynes. 7.30 p.m.
19 **Romford M.E. Club.** Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. Track night.
20 **S. Fed. of M.E.S.** Rally at Peterborough.
20 **Wigan & District M.E.S.** Meeting.
20 **The White Horse M.R.C.** Model railway exhibition, Catholic Hall, High Street, Wootton Bassett, Swindon, Wilts.
20 **The Gauge 1 Model Railway Association.** Salisbury & S. Wilts. exhibition. End to end portable layout. Activity Centre, Wilton Road, Salisbury, Wilts. 10.30 a.m. to 6 p.m.
20 **St. Albans & District M.E.S.** Loco meeting. Townsend School St. Albans.
20 **N.W. Leics. M.E.S.** Trip to the Severn Valley Railway. Depart Snibston Miners Welfare Centre, Coalville at 9.00 a.m.
20 **Perranporth & District M.E.S.** Anniversary steam up at track. 2 p.m.
20 **S.M.E.E.** Talk: "The Orbital Displacer" by Dr. I. J. Spark.
20 **Milton Keynes M.S.** Portable track. Wellsmead School, Bletchley, Milton Keynes. 2.30 p.m.
20/21 **Sacramento Live Steamers.** Spring Meet. California, U.S.A.
20/21 **Maldon Round Table.** (617). Steam in Action. This is S. Essex Traction Engine Owners start of season rally at South Woodham Ferrers, nr. Chelmsford, Essex.
20/21 **Furness Model Railway Club.** Chester-Warrington run. Furness Transport Group.
21 **Guildford M.E.S.** Public open afternoon. 2 to 6 p.m. at H.Q. Stoke Park.
21 **Worcester & District S.M.E.** Public running day. Waverley Street, Dighs, Worcester. 2.30 p.m.
21 **Wigan & District M.E.S.** Outside the Gas Showrooms visit Crich Tram museum. 9.45 a.m. POSTPONED TO 28 MAY.
21 **Furness Model Railway Club.** B.S.M.S. regatta — public park coupled with F.M.R.C. open day on the live steam track.
21 **The National 2½" Gauge Association Rally.** South western at Bristol.
21 **Ardeer Recreation Club.** Model Engineering Section. S.W. Scotland. Meeting 12 to 6 p.m.
21 **Birmingham S.M.E.** Rail outing to Ravenglas inc. a stop at steam town Carnforth and an alternate coach tour to the Lakes. For tickets apply to Sec. Mr. Laking B.S.M.E.
21 **Rugby M.E.S.** Visit to Malden and District S.M.E.
22 **Wigan & District M.E.S.** Visit to Fiddlers Ferry Power station.
23 **Romney Marsh M.E.S.** Track meeting at Rolfe Lane, New Romney. 6 p.m.
24 **Tyneside S.M.E.E.** Slides and lecture on "Canals and Waterways" by Mr. Simkin, at Montagu Baths, Blakelaw at 7.30 p.m.
24/25 **Stafford & District M.E.S.** Public running at the county show. 11 a.m. to 6 p.m. both days. County Showground, Stafford.
25 **to 7 September** Every Thursday. Bressingham Live Steam Museum and Gardens, west of Diss on A.1066 to Thetford Road. 1.30 to 5.30 p.m.
25 **Perranporth & District M.E.S.** Bits and pieces evening/natter night at Perranzabuloe Church Hall. 7.30 p.m.
25 **Leyland Preston & District S.M.E.** Meeting at Roebuck Hotel, Leyland at 8.00 p.m.
25 **St. Albans & District M.E.S.** M.E. exhibition Harpenden public hall. 2 to 9 p.m.
26-29 **S.F.M.E.S.** Exhibition by Brighton Society.
26 **Rochdale S.M.E.E.** Springfield Park, general meeting.
26 **St. Albans & District M.E.S.** M.E. exhibition, Harpenden Public Hall. 10 a.m. to 9 p.m.
27 **St. Albans & District M.E.S.** Model Engineering Exhibition, Harpenden Public Hall. 9 a.m. to 7 p.m.
27/28/29 **Whitchurch (Cardiff) & District M.E.S.** Open days at Headquarters.
27/28/29 **Crofton Beam Engines,** nr. Gt. Bedwyn, Wilts. The Crofton Society, 273 East Grafton, Burbage, Wilts.
27-30 **Mayfair M.E. and master crafts exhibition.** Bristol Exhibition Centre, Canons Road, City Centre, Bristol 1.
28 **Hereford Live Steamers & M.E.S.** John Bertinat to give a talk and slide show on boiler feed pumps. 8 p.m. at Bulmers.
28 **Isle of Wight M.E.S.** Track day at Broadfields, Cowes, I.O.W.
28 **Harlington Locomotive Society.** High Street, Harlington. Public open day 2 to 6 p.m.
28 **Wigan & District M.E.S.** Trip to Crich tram museum — previous date postponed. 9.45 outside the Gas showrooms.
28/29 **Combe Mill Society.** At Combe Mill, nr Woodstock, Oxon. 10 a.m. to 6 p.m.
28/29 **Romney Marsh M.E.S.** Sellindge Steam special.
29 **Bressingham Live Steam Museum & Gardens.** Open 1.30 to 6 p.m.
29 **Malden & District S.M.E.** Open day. 2.30 to 5 p.m.
29 **Guildford M.E.S.** Track event at Surrey county show. 9 a.m. to 7 p.m.
30 **Sutton Coldfield & N. Birmingham M.E.S.** Bits and pieces. Wylde Green Library. 8 p.m.
30 **Stafford & District M.E.S.** Learner drivers night at the track county showground. 7.30 p.m.
30 **Milton Keynes M.S.** Models evening. Royal Engineer. Stratford Road, Milton Keynes. 8 p.m.
30 **and 1 June** International meeting. **Los Angeles live steamers. Golden Gate Live Steamers, Inc.**
31 **S.M.L.S.** The railway will operate. 2 to 5 p.m.

JUNE

1 **Guildford M.E.S.** Visit to Crusaders. 7.30 p.m.
2 **Romford Model Eng. Club.** Competition night.
2 **The Model Engineers' Society. N.I.** Monthly meeting. Cregagh Library, Cregagh Road, Belfast. 7.30 p.m.
3 **Gauge 'O' Guild.** Joint meeting between the guild and the Chilterns Gauge 'O' group at Bassetsbury Manor, Bassetsbury Lane, High Wycombe. 2 to 6 p.m.

Club Chat . . . with the Editor

It's a strange thing that when I was asked for the address of **Andover & District M.E.S.** the other day, I couldn't find it. The next day I received a letter from Mr. R. S. Hammond, Hon. Sec. of Andover club, to tell me that there have been a few changes in Committee. The A.G.M. on 22 March saw the resignation of Mr. D. Hirst, Chairman, Mr. R. Wilkins, Vice Chairman, and Mr. J. Wilkins, secretary. Their places have been taken by Mr. R. Reynolds, Mr. D. Rundle, and Mr. R. Hammond respectively. The club wishes to thank the retiring members for their services and to congratulate Mr. Gordon Howell for being elected to Vice President. Mr. Howell has been in this Society since it started in 1945. The Hon. Sec's. address is 1 Wilmott Way, Basingstoke, Hants.

I notice that **Hereford Live Steamers & M.E.S.** had a talk by Mr. L. Bradd on his 3½ in. Britannia and that John Haining was scheduled to visit the club on 28 April. Mention of the Britannia reminds me that the full-size job has her first steam up this month after some Trojan efforts by the Society concerned and I hope we will be able to publish some pictures of this event.

Last year I visited the annual Model Traction Engine Rally organised by **Bedford M.E.S.** and it bucketed down. That was the day John Haining went and lost his exhaust pipe driving back from Bedford. Well, let's hope this year's Rally, to be held at the track site, Wilstead on 20 August will be visited with some sunshine and a less noisy John Haining. The event starts at 11 a.m. and visitors wishing to bring a T.E. should contact the secretary, Mr. R. J. Tingey, 14 Rosslyn Crescent, Luton, Beds. LU3 2AU.

Here's another change of secretary, this time at **Southampton & District S.M.E.** where Mr. R. Garment of 2 Nickson Close, Chandlers Ford, Eastleigh, Hants SO5 1HD assumes the role. I would appreciate the secretaries of clubs who have not written to us lately to let us know the names and addresses of club and secretary. A glance through our cards has shown that some of the information contained therein is several years old and we are constantly being asked for the addresses of clubs in all areas. One we have heard about is at **Leicester S.M.E. Ltd.** where Mr. R. L. Moore was elected as Chairman at the A.G.M. on 6 March. The secretary is still Mr. D. McCullough of 13 Broadbent Close, Whetstone, Leicester.

It's nice to see that the **Guildford M.E.S.** members who visited this year's Model Engineer Exhibition enjoyed themselves and thought the visit worthwhile. A view is that the number of models was disappointing particularly among the locos. This may well be justified but if people don't enter their models what can we do? Press gang? I will say this much, the number of model engineering exhibits was 210, the highest since the war. But we, too, would like to see more; we, too, would like to make the Wembley show pleasing for everyone. So suggestions — and better still, entries, are very welcome. While we are still at Guildford, don't forget that this club is playing host to IMLEC on 9 July this year. Entries are now coming in — including Bert Perryman's "Gladstone" which was featured in *M.E.* last year. Having seen it at Brighton I can vouch for it being an extremely attractive model and it should be interesting to see how it performs. Guildford follow IMLEC with their own Model Engineering Exhibition, a week later.

Paul Wiese, 6 Halliwell Road, Redcliffe Bay, Portishead, Bristol, is Hon. Sec. of the **National 2½ in. Gauge Association** and tells me that membership is on the up which is good to hear. Three rallies in 1977 were well supported and four are scheduled for this year. The dates will be given in Club Diary. Mr. Wiese has promised us some details of a 2½ in. gauge A3 Flying Scotsman which the Association is working on and these will be very welcome. The loss of the Sarawak Trophy reported in Smoke Rings a few issues ago brought a little bit of its history from Mr. Wiese and the knowledge that at present there are about 14 Dyaks in the Association. **Bristol S.M.E.E.** has just opened their 2½/3½ in. gauge track at Ashton Park and **Stockport M.E.S.** are laying a 2½ in. track on their existing 3½/5 in. Incidentally, Mr. Wiese tells us that the original master drawings for LBSC's Green Arrow in 2½ in. gauge have been added to their list. The seven sheets cost £3.25 but presumably one would need to be a member of the Association first.

I'm afraid we received too late the news that **Howard & Halesworth M.E.S.** were holding a Model Engineering Bonanza in conjunction with Mr. L. Murray of the Agricultural Museum, Wood Farm, Sotterly, Suffolk on 30 April and 1 May. The idea is to foster model engineering in that area and I am all for this, so I hope the event was well supported. If there is another show later on we will try and obtain particulars in time but please remember, all you Hon. Secs., that we need to have details six weeks before publication date.

Did you know that during Spring Bank Holiday weekend there will be a **Mayfair Model Engineering Exhibition** at The Bristol Exhibition Centre? One floor of this Centre has been given over to model engineering with something like 15,000 sq. ft. of area so it is promised to be the largest exhibition of its kind in the West of England. There are details available for companies wishing to be there so a telephone call to Rick Wrixon on Bristol 292156/7/8 should tell you all you need to know.

At **Teesside Model Railway Engineers** the new Chairman is Mr. P. D. Harrison of 5 Darcy Close, Yarm, Cleveland. The club meets every Wednesday at the Elmwood Community Centre, Stockton-on-Tees where a 00 working layout operates and a 0 branch line is under construction.

From way down at **The Otago M.E.S. Inc.** in New Zealand comes news that the Festival Week has been a resounding success and the photographs in the current "Con-Rod" prove it. According to figures available 5300 adults and 3400 children visited the exhibition and there was even a busload of Australian railway enthusiasts. The number of passengers carried on the track was 9270 which, if my maths are correct means that quite a few went back for more. Probably most of the members were so engrossed with the preparations for the Festival Week that they overlooked the club meeting for November. At the Bits and Pieces event there weren't any! Well it had to happen somewhere.

The **Golden Gate Live Steamers, Inc.** held an Installation Dinner in January to present the new officers and to honour Harry Dixon, secretary of the Brotherhood of Live Steamers for many years. The club gave Mr. Dixon an engraved plaque as an appreciation of his services. The secretary here is Mr. John Nicholson of 2072 Stewart Avenue, Walnut Creek.

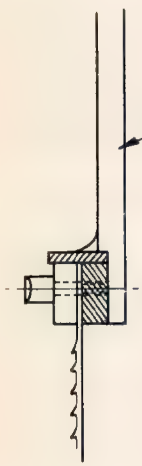
Don't forget **The Historic Commercial Vehicle Run** — London to Brighton — on 7 May, sponsored by Fodens Ltd.

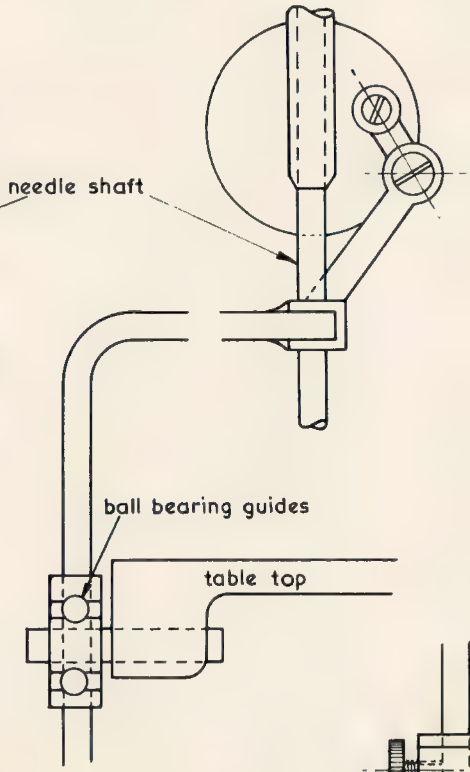
Post Bag

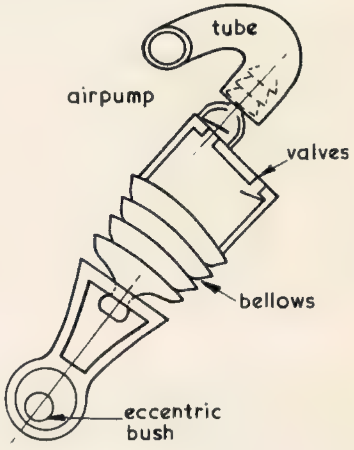
The Editor welcomes letters for these columns. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

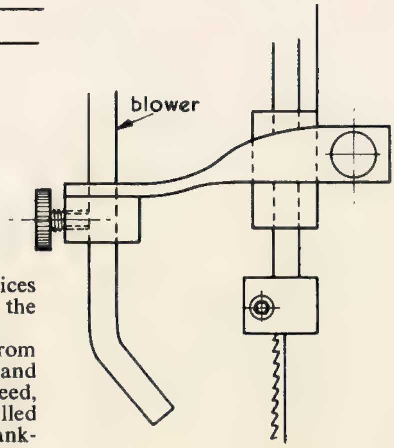
Jig Saw Machine

SIR,—After I had given somebody a model boat kit, which was left in its box because of the sawing involved, I decided a jig saw machine was called for. I studied the commercially available ones and found that unless one was willing to pay about £200 for a professional machine, they were no good. Either they had special sawblades—expensive, difficult to obtain, only for wood and too wide for intricate work—or they were so shoddily made, that I thought I could





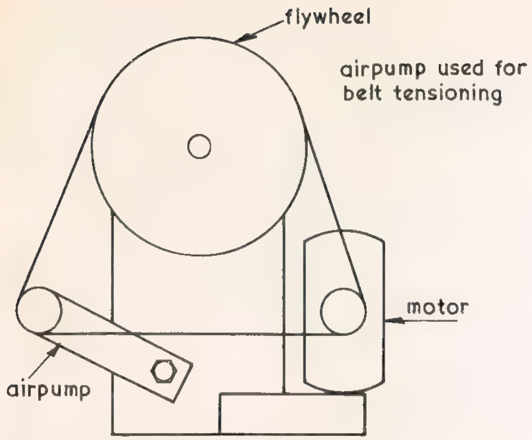




improve on that. None had variable speed or devices to keep the sawdust away from the pattern so the machine had to be "home-spun".

As I have an unholy fear of starting something from scratch and as there is a machine that is sturdy and well made, goes up and down and has variable speed, I took an old sewing machine. This was disembowelled (takes power and makes noise) except for the crankshaft, needleshaft and the tissue-down-pressure.

A U-shaped frame was bent from 6 mm. square mild steel. This was welded to the little block that connects the arm of the crankshaft to the needle shaft. Make sure that the bottom bit clears the bench as well as the underside of the table casting. In my case the stroke of the needleshaft was 30 mm. and I had to file away a bit of the stiffening rib of the casting. The U-shaped frame could be made as deep as you like but I do not think it sensible to exceed 10 cm. I have a deep framed jig saw, which I never use, and a shallow one (Eclipse No. 50) which with a little ingenuity is capable of almost any work. As the distance between the middle of the needle-shaft and the edge of the table was 80 mm., I decided this was wide enough. Also it made fixing the ball bearing guides much easier. The table edge was filed away up to the stiffening rib, the frame hammered and "violated" into its proper place and shape, and then the two enclosed 22 mm. outside diameter bearings clamped closely to the flat sides of the frame. Through the 8 mm. inner rings of these bearings an 8 mm. twist drill was used as a centre punch. Two 7.9 mm. holes were drilled and the bearings were locked tight on 8 mm. stubshafts



pressed in these. Next came the air pump. A 10 mm. ballbearing spindle was fitted with a pulley in line with the flywheel and the motor pulley. On the other side of the spindle an eccentric bush was fitted, which throws an arm, which in turn is attached to the end of little rubber bellows. These end in a little nylon chamber with two opposed non-return valves. From there the air goes through a plastic tube to a 6 mm. steel tube the last 30 mm. of which is bent about 30°—the tube is held in a bush by a grubscrew. The bush is fitted to the frame by a piece of 2 mm. flat steel which is turned halfway 90°. Consequently by loosening the grubscrew and the bolt fixing the flat to the frame, height and position of the blower can be adjusted. The motor, flywheel and air-pump were all connected by a piece of 5 mm. round nylon belt, which can be butt-welded by pressing both sides first against a hot knife and then against each other and holding them very still even though you are burning your fingers, till they are cooled. I have never seen this material mentioned and I find it a godsend. It is available in sizes from 2 mm. upwards to 10 mm. Giving you the Dutch supplier would not help, I am afraid—ask around—it's very handy.

The saws are fixed between two pieces of 4 mm. mild steel flat, approximately 10 mm. square—one has a 4 mm. clearing hole and the other is tapped. On top of the tapped one a piece of 1 x 8 x 10 mm. is soldered square to the flat so the other one does not turn with the Allen head screw used to tighten up. File a flat parallel to the frame on the needle shaft and weld or silver-solder your first clamp. Then fit the second set on the bottom of the frame flush with the bottom flat of the frame, or else you think you have become a "medium" as there is a loud knocking on the table. Be sure to get the two clamping surfaces precisely parallel. The performance of the device depends on it. Also get the two tapped holes precisely vertically in line with the bolts so that they can be used as stops whilst using your saw vertically.

Further refinements are possible, such as a work-light, various guides, a compass clamp to make discs, etc. For metalwork mine is connected to the milling machine's suds pump at half speed.

It took about four to five hours to make, especially because the air pump which I described was taken straight out of an old IBM photostat machine. It all depends on the contents of your scrapbox—you might even have an old jig saw machine in there.

Leiden. H. I. Gosses

Modifying the Unimat

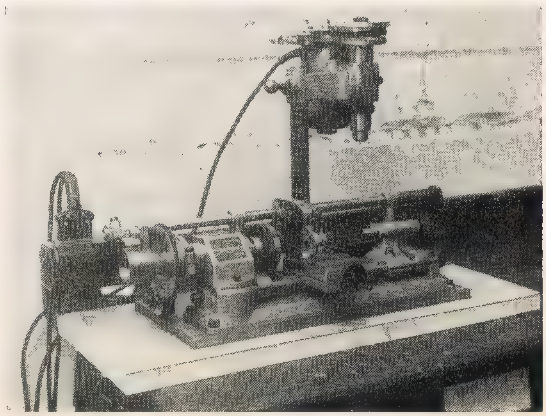
SIR,—I have been a regular reader of *Model Engineer* for the past two years. In particular I am following Mr. Tingey's articles on the Unimat lathe, and I hope he will continue with these.

As a matter of interest I am enclosing photographs of my own lathe, bought two years ago. The first job I ever did was a 1/20 scale 24-pounder cannon, the same as the one shown on page 1267 of the November edition. The cannon was in an article by W. E. Barton in *Popular Mechanics,* February 1969, and every operation was carried out on the Unimat SL. The cannon was almost finished when the electric motor started running irregularly and losing power. I sent the motor to the Unimat agent in Dublin. Meanwhile I started to look around for a substitute. I was able to buy a sewing machine motor and foot control very cheaply. I find the new position of the motor very satisfactory and the foot control very useful, leaving both hands free, especially when using the threading attachment. I have also extended the guide bar over the headstock, thereby eliminating the necessity of dismantling the chuck every time the threading attachment is needed.

Although shortly afterwards I was supplied with a new Unimat motor by the agent, I decided to leave the lathe as it was. I have now been using it for 15 months trouble-free. The guarantee of the Unimat had just expired when there was a play on the main spindle. At the time I had no access to a larger lathe, so I bought a new spindle and later I was able to rectify the faulty one. I now had a new motor, a new spindle and the double reduction motor bracket. I only needed another headstock and a means of fastening the vertical column square with the lathe, and the solution I came up with is shown. The main base consists of $\frac{3}{8}$ in. mild steel precision ground $7\frac{1}{2}$ in. x 15 in. I have drilled and tapped holes for different positions, two for the lathe and three for the milling post. The base is a simple 3 in. aluminium cylinder bored to take the column. In line with the mounting block I have mounted a $2\frac{1}{2}$ in. square block, with holes tapped for mounting the milling table, so that I can carry out normal drilling operations.

I am a dental technician and I have found lost wax casting in brass and aluminium very useful to my hobby. At the moment, I am making a steady for the Unimat by casting. My next project is to make a dividing disc on the main spindle so that gear-cutting and all operations needing dividing can be carried out without removing the work from the chuck.

Dundalk, Ireland. Franco Fornaciai



Screw-cutting Odd-pitch Threads

SIR,—As the one who originally commiserated with the unfortunate owners of lathes with Norton gear-boxes I must thank my good friend George Thomas, in his letter to "Post Bag" 2 December 1977, for exemplifying the very point that I was trying to make.

It is of course perfectly true that setting the Norton box to cut 13 t.p.i. and then using $\frac{20 \times 38}{50 \times 45}$ as transposing gears one can cut a very good approximation to 4 BA but unless one has a full set of change wheels *as well* as a Norton box where does one get them? The answer is that they are there already, particularly the 38T which would be used for cutting 19 t.p.i. and the 45T which would be used for cutting 18, 27 and 36 t.p.i., but they are tucked away inside the box where they cannot be got at and can only be used for cutting the pitches the maker intended.

On the other hand I have got all the gears for $\frac{20 \times 38 \times 40}{50 \times 45 \times 65}$ hanging up on a board behind the lathe and it would be the work of a moment to set it up on the banjo. No, Norton boxes are for production lathes where semi-skilled operators cannot be trusted to set up even the simplest gear trains and for tool-room lathes where, with a full set of transposing gears and at considerable extra cost, the most sophisticated work can be done. But the amateur can have the best of both worlds at a cost less than either if all the wheels are supplied loose and as I showed in my article on "Ringing the Changes" tens of thousands of trains are possible with a standard set of change wheels. Incidentally $\frac{20 \times 20}{35 \times 55}$ with a banjo or $\frac{20}{35}$ with the Norton box set to 22 t.p.i. is a marginally better approximation to the pitch of a 4 BA screw (taken to four decimal places) and has fewer gears than the double compound train.

But I entirely agree with George Thomas that this is of academic interest only and we have both of us had much fun with a marvellous article by O. Lichtwitz which he discovered which not only gives in detail the method of continued fractions but the use of matrices to find intermediate fractions with known degree of error and the setting up of spiralling trains in non-differential gear hobbing machines. I regard it as the last word on the subject but the problem with which we are faced in practice may come in one of three categories:

1) To find the best gear train with the gears which we have got.
2) To find the best train assuming we have, as with most tool-room lathes and gear-cutting machines, a complete set of change wheels containing all factors and prime numbers up to 100 or 120.
3) The sky is the limit where any number of teeth can be chosen.

It is with the first of these that the amateur will be mostly concerned and here the owner of a lathe without a Norton box is at a distinct advantage since all the gears are available all the time for any train he may wish to set up.

While on the subject of ridding our lathes of useless frippery I would cite the tumbler reverse gear as a prime candidate. It employs four gears, which cannot be used for any other purpose, to do what can be done with any single gear from the set as an idler; cannot be used in screw-cutting and wastes good space between the mandrel and the lead screw. At admittedly greater cost but still much less than that of a Norton box we could have a one-tooth reversing mandrel clutch which enables the lead screw to be reversed when cutting *any* pitch, metric or fractional, and to be re-engaged at any time without reference to a thread indicator. If equipped with a 36T transposing gear as the "Hendy" lathes it also enables multi-start threads with 2, 3, 4, 6, 9, 12, 18 or 36 starts to be cut with absolute certainty of correct spacing and pick-up regardless of lead. It seems a great pity that lathe makers, while anxious to copy the "Hendy-Norton" box, seem to have ignored the even more important feature of a reversing mandrel clutch with which these splendid lathes were equipped.

Quorn, Loughborough. D. H. Chaddock

Ornamental Turning

SIR,—Though by no means worthy to do so, I must rise to the defence of J. J. Holtzapffel, mentioned in Allan Mackintosh's article on page 134. First, the artefact illustrated on page 158 (Plate VI) of the book is a toilet *ring* stand; used by the lady of the house to stack her rings on and not for the more fundamental purpose suggested by Mr. Mackintosh!

Second, though the examples shown in the book may appear to be over-elaborate it must be appreciated that they were designed and made to show the full capabilities of the machines and equipment described by the author. Anyone reading the book will find that Holtzapffel repeatedly stresses the need for restraint in decoration, especially when using woods possessing their own intrinsic beauty.

Third, the "Curvelinear Apparatus" as described does work exceptionally well, and most of the alleged "twiddly bits" serve a definite purpose. Fig. 96, of course, includes an Ornamental Turning sliderest, and it may be that Mr. Mackintosh hasn't realised this. Incidentally, this sliderest *can* be used with power feed, and attachments for this purpose were available as far back as 1840. This is not to say that Mr. Mackintosh hasn't added some improvement with his device, of course.

As to the price mentioned for a Rose-engine (which is a very different kettle of fish from a normal Holtzapffel lathe) I think this is a bit of mythology! (Like the seals on Rolls-Royce's carburettors.) I have looked at the register from 1810 till about 1850, and find 11 Rose engines made in that period. One is not priced, but the others ranged from £210 to £330 each—excluding Lord Minson's (No. 1593) which cost only £30, and which I think may refer to a Rose engine attachment. The normal screw-cutting Ornamental Lathe of 1840-odd cost between £20 and £40, but one could, of course, add a lot more for specialist chucks, etc.

Ivory was and is available in quite large sizes—I have a piece over 4 inches on the minor diameter and this is not considered a large tusk. Most of the illustrations in the original book were full size, and the Tazza was 4 in. dia. on the bowl. The celebrated "Ivory Tower", made to illustrate the capabilities of the "Rectilinear Chuck", was 21 in. tall, and can be seen still at the Science Museum, South Kensington. It is well worth going to see—there are other examples of similar work as well as Ornamental and Rose engine lathes adjacent.

Work in metal is quite feasible, and I use my Holtzapffel made in 1805 for turning oval gland and pipe flanges; *and* make tool handles with the curvelinear apparatus of No. 2456 made in 1896!

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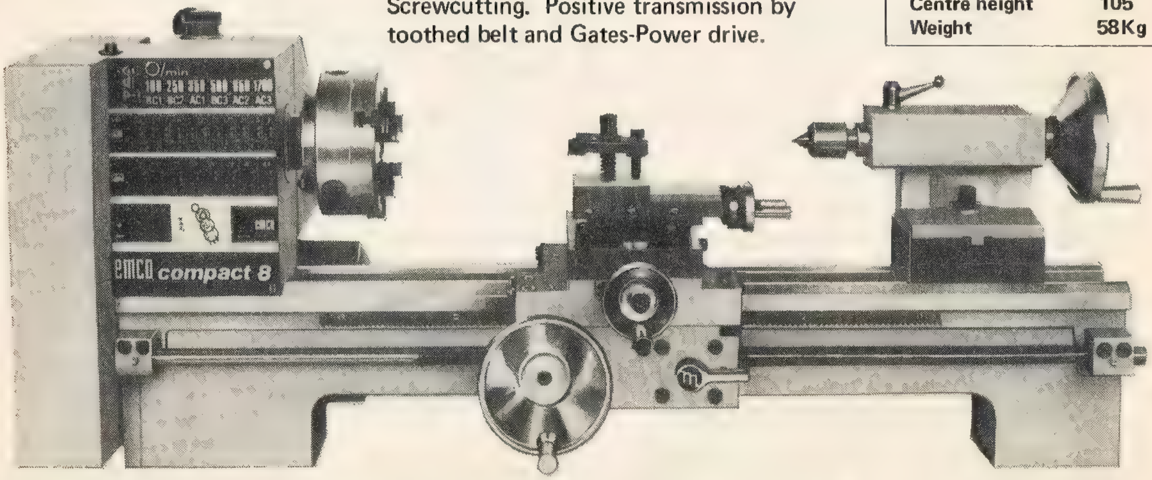

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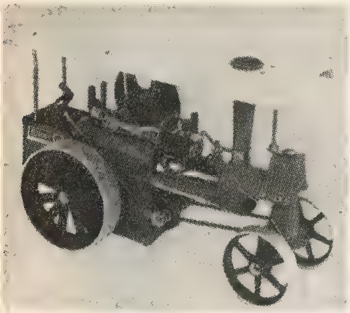

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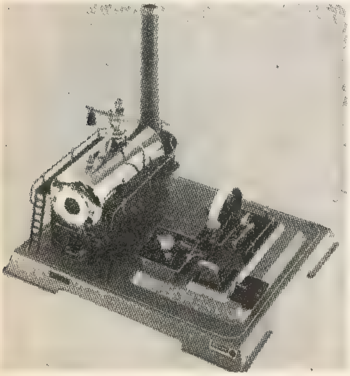

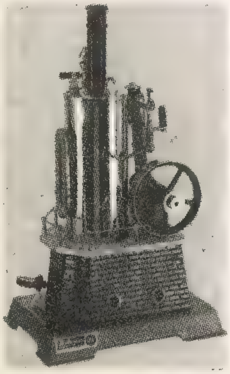

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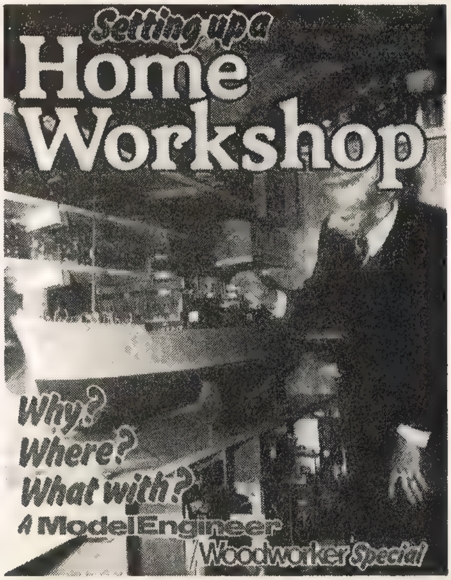

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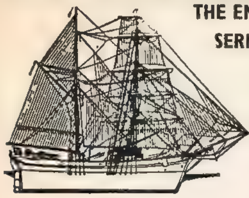

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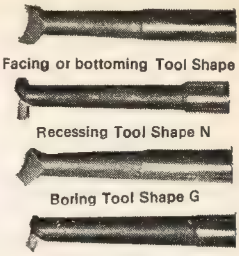

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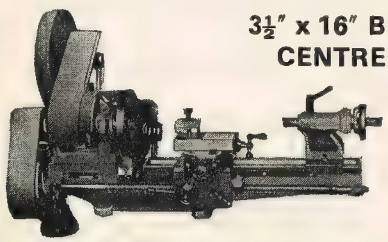

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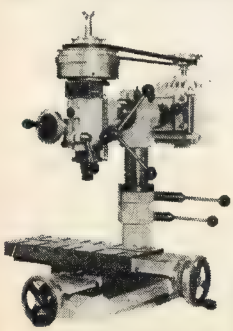

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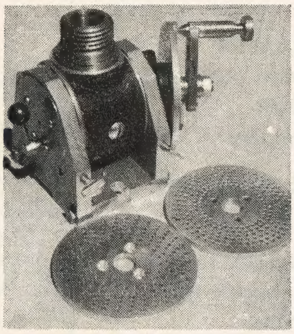

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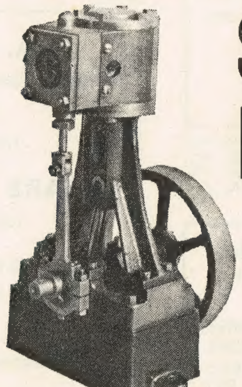

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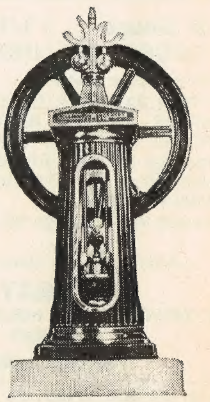

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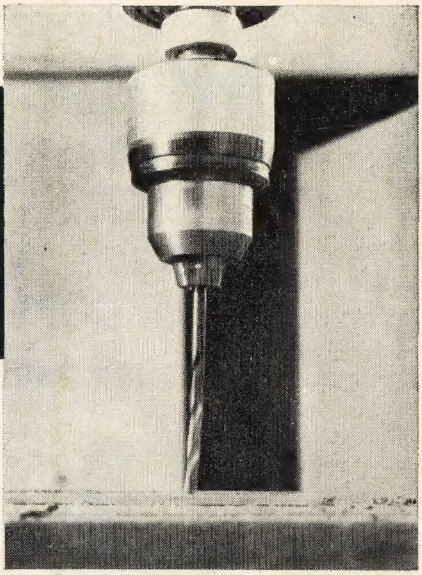

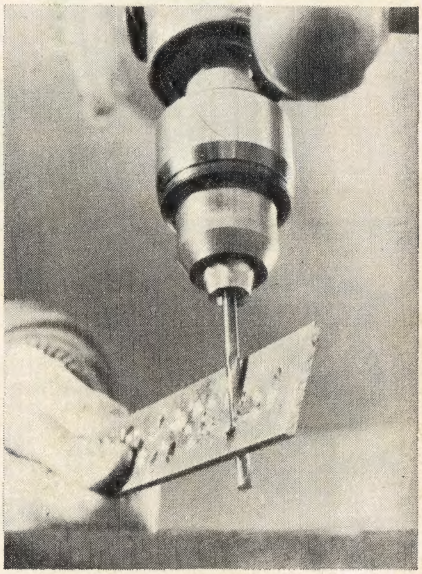

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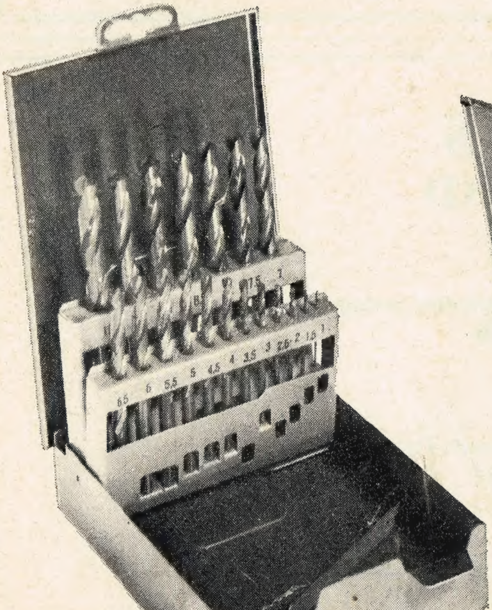

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